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Regionalization in Alaska: An Evaluation of the Significance of Newspaper Circulation and of Air Route Networks

by

Kenneth Allen Holm

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William C. Wonders

Supervisor

Date August 19, 1982

Abstract

Regionalization schemes are indispensable to proper regional planning. Their boundaries provide the areal divisions within which data are collected and analyzed. From this data decisions about development can be made. This particular study seeks to serve such a purpose. It sets out a regionalization of the tertiary sector of the state of Alaska. The two criteria used in this study to delineate regional boundaries are newspaper circulations and scheduled air route networks.

Although there are regionalization schemes for the state of Alaska in use based on socio-economic and physiographic characteristics, the importance of this study lies in the fact that there has been no prior regionalization of the state in terms of the tertiary sector. It will therefore provide planners and businessmen with a new set of perceptual boundaries for present and future planning.

Acknowledgements

I wish to express my sincere thanks to Dr. William C. Wonders who served as my supervisor and who patiently and diligently provided me with the critical guidance needed to complete this thesis. I also wish to express my appreciation for the advice given to me by Dr. J. K. Fairbairn and Dr. R. A. Pendergast.

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I. Introduction

A. The State of Alaska

Alaska has several unique geographical characteristics which individually or in combination produce distinctive functional, physiographic and socio-economic patterns on which regionalization schemes are based. Over the last century these regionalization schemes have divided the state into various spatially functional patterns. The unique geographical characteristics of Alaska include: its great size, the configuration of its major landforms, and its small and scattered population. When combined with the lack of an adequate surface transportation system, these characteristics result in an isolation of settlement patterns to a degree not found in the other states of the United States of America.

Alaska is a state of immense dimensions when compared to any other in the union. It contains approximately 943,517 square kilometers (586,400 square miles). This is more than twice the size of Texas or in a Canadian context, more than twice the size of the province of Alberta. The relative size and geographical extent of Alaska as compared with the contiguous[1] United States is illustrated in Figure 1. Longitudinally it would extend from the southeast seaboard to the west coast of California and latitudinally from the Minnesota/Canadian border to the Texas/Mexican border.

Alaska's major river valleys and mountains have provided the traditional framework by means of which to assess the potential of the natural resources and understand socio-economic characteristics of the state on a regional basis. These physiographic features, especially during early exploration, could be likened to the 'push-pull' concept in population migration. Here the 'push' factor in Alaska is provided by the inhospitable mountains within the state[2]. The mountains therefore, represent an area which lacks amenities for settlement and retards resource exploitation. The 'pull' factor is represented by the river valleys in that ease of transport is inducive to both resource exploitation and settlement.

---

[1] Because Alaska is geographicaly separated from the rest of the United States, terms such as 'contiguous United States', 'lower 48', and 'outside' are commonly used by Alaskans in reference to their southern counterparts.

[2] There are a few exceptions to this example. One specific exception is the small village of Anaktuvik Pass which is an isolated village situated along the foothills of the Brooks Range.

Figure 1 A SIZE COMPARISON OF ALASKA WITH THAT OF THE CONTIGUOUS UNITED STATES
Source: Alfred Brooks, 1906.

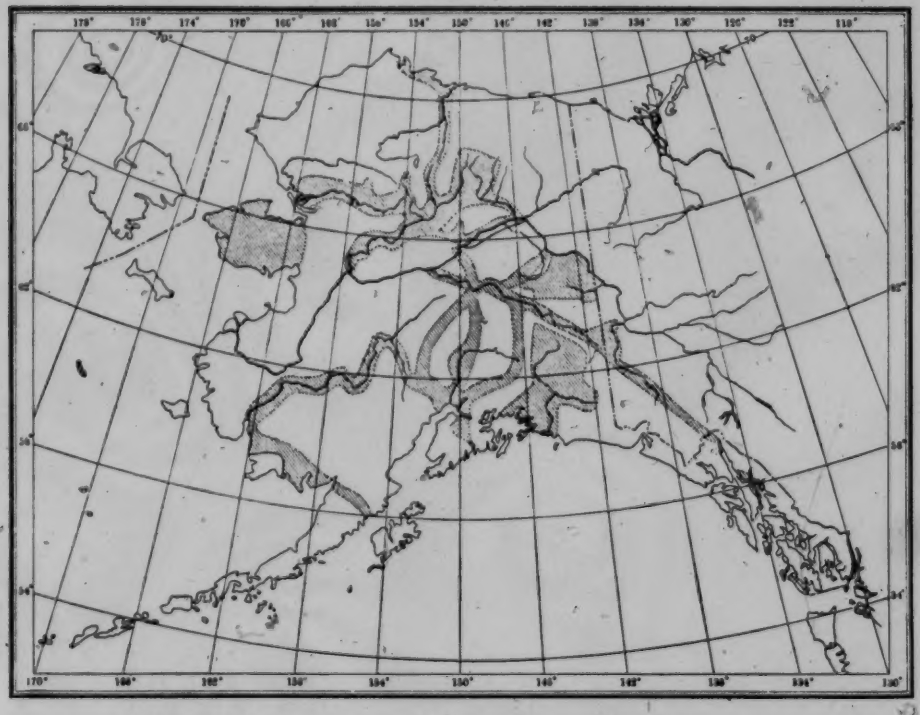

Figure 2 AREAS OF U.S.G.S. SURVEYING 1898–1903.
Source: Alfred Brooks, 1906.

The importance of rivers as a means of travel can be shown by their frequent use historically in the exploration and surveying of the Alaskan interior by the United States Geological Survey starting in 1885. Figure 2 by Brooks (1906, p. 13) illustrates this point.

River travel also was critically important in the setting up of early judicial divisions in the state (then a territory). These divisions were determined by how far a district judge could travel by steamboat in one day (Rogers, 1962, p. 118).

The population of Alaska still remains small, especially in relation to its size. For example, in 1930 the population density was only .001 persons per square mile (National Resource Committee, 1957, p. 35). In 1970 this had increased to only 0.51. This compares with a 1970 density figure of 4.72 for the state of Montana, which is one of the lowest found in the 'lower 48' states.

Besides density of population, its pattern of concentration is also important. The four major populated boroughs of Alaska, with populations estimated by the Department of Community and Regional Affairs as of July 17, 1978, are: Anchorage, pop. 202,101; Fairbanks, pop. 66,222; Juneau, pop. 22,105; and Ketchikan, pop. 13,071 (Harrison, 1979)[3]. These four boroughs, in 1978, represented 67.3% of the state's total estimated population of 451,061. The remainder of the population is scattered throughout the state in small cities, towns, and villages. Most of these places have less than 2,500 people, and in many cases less than 1000 inhabitants. This latter category includes 255 places or 86.4% of the number of all places incorporated and unincorporated in the state.

The combination of great size, the isolating impact of major mountain ranges and valleys, and the sparseness of population along with the lack of reliable surface transportation links between communities, results in settlement isolation as a common phenomenon. For this reason, the air transportation system plays a vital role in overcoming the isolation factor in Alaska. It is this system which provides for the provision of goods and services throughout the state on a year-round basis. This route network, which began with mail service in the mid 1920's, has expanded to the point where today it brings air service to more than 230 communities within the state (United States Civil Aeronautics Board, 1980).

---

[3] It is recognized that these population figures are somewhat dated, but because 1980 census data on population counts are still preliminary and in some cases have been challenged as to their accuracy, 1978 data estimates were chosen to reflect the state's population.

In summing up, a quotation from Rogers (1962) probably best describes the uniqueness of Alaska's characteristics:

> "In attempting to get a true nature of a subject, one very naturally begins to work impressions into a model or simple pattern resembling the more complex and illusive reality. Because of its great physical size and the relative simplicity of many of its elements, Alaska, lends itself easily to this sort of construction. The sense of moving between several entirely different physical worlds as one travels about Alaska is one of the first and strongest impressions gained from a flying visit. Physical geography dominates any attempt at analysis (p. 15)."

B. Objectives and Purpose

Alaska, as mentioned earlier, has been divided into various types of regions and subregions depending upon the wants and needs of the particular group of individuals at the specific time of study. Physiographic features (Brooks, 1906; Wahrhaftig, 1965), natural resources (National Resource Committee, 1937), and population census districts (United States Department of Commerce/Bureau of the Census, 1973) have all been used to identify distinct regions within the state.

Although these statewide and regional studies have been useful in respect to natural resources and socio-economic planning for the primary and secondary sectors of the state's economy, studies on the tertiary section have been lacking. It is therefore the intent of this study to use a different set of criteria for determining various regional boundaries of the tertiary sector of the Alaskan economy. The two criteria used to accomplish this goal are newspaper circulation and the air transportation system.

To produce regional divisions on a local and statewide basis each of these criteria has been analyzed and mapped separately. The final analysis combines the regional divisions of these criteria to produce a statewide map of the retail trade interactions.

Newspaper circulation patterns were considered the main indicator of a city's primary retail trade area, and also an indicator of interaction between the six major cities studied. The air transportation systems, on the other hand, served two purposes. First, they were considered a primary indicator of intercity trade. Secondly, as an indicator of city-hinterland interaction, they helped to strengthen the determined regional retail trade boundaries through the system's structural and functional organization.

C. Methods of Research

Newspaper distribution was based upon circulation data which were collected through a mail survey questionnaire in 1976 and the ABC Audit Report--Newspapers (See Appendices A, B, and C.). The cities which were covered in the analysis were Anchorage, Bethel, Fairbanks, Juneau, Ketchikan, and Nome. These cities are shown in Figure 4 on page 15. Reasons for the selection of these cities are as follows. They all function as regional centers. They are among the largest cities in the state, and they all publish newspapers on a bi-monthly or greater frequency. Finally, pairing of cities with respect to trade area competition and interaction was a factor in city selection. Ketchikan and Juneau represent Southeast Alaska, Anchorage and Fairbanks represent the central region of the state, and Bethel and Nome the southwest and northwest regions.

Analysis of the theoretical newspaper boundaries was based upon the breaking-point formula which was derived from Reilly's "law of retail gravitation" (Yeates & Garner, 1971, p. 103) which states the following:

$$\text{Breaking point from City A} = \frac{\text{Distance between A and B}}{1 + \sqrt{\frac{\text{Population B}}{\text{Population A}}}}$$

where A and B are competing cities,

D is the distance between the cities,

and P is the population of cities A and B.

Through the use of this formula and of actual newspaper circulation data, determination of both the actual and theoretical boundaries of retail trade were determined and compared and an evaluation made of the conformation between the two.

For the air transportation system, several aspects were examined. First the air route systems for the Bethel,Nome, Juneau, and Ketchikan trade regions were analyzed and examined[4]. Analysis included the mapping of active air routes as of September, 1981, for each of the trade regions as identified by newspaper circulation. Data for this analysis was obtained from The Official Airline Guide: North American Edition (September, 1981). From this analysis further information was extracted so that sub-systems, route circuits, and intercity interactions could be determined.

The second part of the air system analysis for each of the four newspaper trade regions as listed above, compares and contrasts selected characteristics of the pre-determined newspaper boundaries, and newspaper circulation data with that of the existing air route sub-systems within each region. The analysis was examined by mapping the air route systems of each of the four regions on the newspaper trade area maps. From this combined map these two regional trade indicators were examined to compare their areal extent of trade.

After mapping, a third analysis was made by combining newspaper circulation and sub-system route data. This information was used for determining the degree of correspondence between the two trade regions, and also to determine specific characteristics which the two indicators had in common within their regional trade area.

Also for the Bethel-Nome region, simple linear regressions were calculated to determine the relationships which exist between population and leg frequencies[5] within sub-systems, between distance and leg frequency, and between population and average deplaned cargo per departure. In this analysis population and distance were independent variables and leg frequency and cargo were the dependent variables.

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[4] This analysis excludes the determination of the scheduled air route structures within the Anchorage and Fairbanks trade regions. These regions were omitted in this section of the study because this analysis places emphasis on the support services which are provided by scheduled air carriers to outlying areas from the less populated centers within the state.

[5] Leg frequency is defined as the total number of all scheduled stops made by scheduled air carriers within a route network of a sub-system. It is therefore used as a measure of the intensity of interaction within and between sub-systems.

For the section on spatial flow analysis of the air route sub-system, thoughts and methods of implementation were drawn upon from previous and similar studies done by Conzen(1975), Taaffe (1956,1962), and Ullman (1949). Population data used in this thesis for analysis were taken from two sources. The first was the 1970 United States census statistics and the second was Civil Aeronautics Board dockets. The former data base was used in conjuction with newspaper circulation data. It was preferred over the use of more recent population estimates found in other sources for the following reasons. Many of the villages in this study have small populations and are of minor importance as statistical indicators. Therefore, a complete set of estimates could not be found for all these places during the 1973-1974 time period[6].

A second problem also became apparent with the larger settlements in the study. This problem centered around the question--what is the particular city's population? The root of this problem appeared to be centered upon the way in which census divisions are defined within the state. For example, Juneau, Alaska, is listed both as a census division and as a city and borough. The city is listed as having a population of 6,050 in 1970 and the borough and census division as having 13,556. The problem here is twofold. First, if population estimates are used for years more recent than 1970, reference sources will list different population figures and will not explain if they are city or borough or are arbitrarily defined city boundary counts[7] Secondly, is the fact that if a borough, which is very large in areal extent, is chosen as a population figure for a city's population, then other settlements that are external to the city will also be included in the population count.

As mentioned, the second source of population data was Civil Aeronautics dockets EAS105-EAS-333, and EAS 347 (1980). This set of statistics is 1978

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[6] The use of data for this time period is due to the fact that 1973 represented a relatively stable period of socio-economic activity. Growth due to the building of the Trans-Alaskan Pipeline, which in general lasted from 1975-1977, had not yet begun. Therefore, data from census statistics which are used in this thesis in reference to newspaper analysis conform as closely as possible to the pre-pipeline construction period.

[7] American Newspaper Representatives, Inc. National Directory of Weekly Newspapers N.Y., 53rd edition, 1973.
Anchorage-124,542, Fairbanks-45,864, Juneau-13,566, Ketchikan-10,041.
The Milepost, Alaska Northwest Publishing Co., Anchorage, Alaska, 1974.
Anchorage-76,610, Fairbanks-27,500, Juneau-7,000, Ketchikan-11,000.
Ayer Directory of Publications , Ayer Press, Philadelphia Pennsylvania, 1976.
Anchorage-48,029, Fairbanks-14,771, Juneau-6,050, Ketchikan-6,994.

estimates and is used in conjunction with the study of air route systems.

D. Literature Review

Generally speaking there has been little work done by geographers pertaining to transportation and economic aspects of the Alaskan environment. This is especially true since the 1970's. Two types of studies may be discerned. The first type is population-settlement studies which constitute the majority of written articles. The second type is related to regional delineation or spatial flows of goods and services.

In regard to the first type of studies, Kirk Stone was probably the most active geographer producing articles on Alaska (Stone, 1950, 1952A, 1952B, 1966). Other geographers who have written on Alaskan settlement are Foscue (1934) and Brown (1969). Stone's articles differ somewhat from the latter two authors in that he placed more emphasis on statewide studies. He particularly concentrated on studies pertaining to historical growth patterns of the white (non-native) population, and associated functional growth of cities. The exception to this was his study of the Matanuska Valley Colony. This was a study of the settlement of a particular valley north of Anchorage. The latter two geographers were more concerned with specific areas or towns in Alaska and their historic evolution.

Two studies concerned with regionalization or spatial flows are Stanton (1955), and Siddall (1956). Stanton's study was concerned with the reasons why people came to Alaska, where they came from, and by what mode of travel they came. Seasonality of traffic volume was also considered. The main reason for this study was to assist the businessmen in planning for future growth of business and summer tourist traffic. Siddall's study involved a brief analysis of regional network flows within the state and between the state and Seattle, Washington. To determine these flows of interaction, he used the following criteria: scheduled air routes and available seats on aircraft between places, telephone calls, places of residence of college students at the University of Alaska and the University of Washington, and finally the ratio of wholesale to retail trade workers for the state was determined and then compared with the national averages of

other states.

Because of this lack of geographic literature pertaining to regionalization and spatial flows in Alaska, I have chosen to focus upon two criteria which I feel are very important as indicators of spatial flows. These are newspaper circulations and air route structures. I believe this will help broaden our understanding of these networks and their interdependencies in Alaska.

II. The Regional Concept: Its Definition and Application in Alaska

Through time there have been changing ideologies of regionalization. These are surveyed briefly from the geographical perspectives in the first section of this chapter. The main focus will be on the differing concepts of a 'region' as an absolute space and as a relative space. Also included is a brief synopsis of current thought about what constitutes a region today.

The second section of this chapter describes some of the various approaches which have been used to divide Alaska into distinct regions to the present. Selectivity in choice of regional division schemes has been used. Three types of regionalizations are considered, as they are most relevant to the two criteria chosen for analysis in this study. These three types are physiographic, socio-economic, and an institutional scheme of regional division.

A. Regional Definitions

Attempts to define a region and to determine its boundaries are arduous tasks. First, a need for a regionalization scheme must be identified. After determining that there is in fact a need for regionalization, the appropriate criteria for the study must be chosen. It must also be determined if there is an adequate source of data available to complete the study. The size and complexity of the regionalization scheme must be considered, as well as the methodology to be used in determining the regional boundaries. For example, a study could be implemented on a macro-scale or a micro-scale. In other words, the data base could be a large area used to produce regional delineations, or the data could be taken from small areas and assembled to produce larger regions. This study used the macro approach.

The concept of the region has been discussed by geographers at least since Kant's time and the region has often been considered the major focus of the discipline of geography by some scholars. Kant viewed space as an unique absolute whole, its

measurement calculated by straight line Euclidean geometry. This particular measurement was universal for all spatial interaction between phenomena. A further characteristic of this measurement was its constant value (Harvey, 1973 p. 72-73).

Even though Kant's philosophic concepts are upheld in modern geography today, there is the opposing relativistic approach which developed with the beginning of location theory. This particular approach is dominant in today's geographic literature (Harvey, 1973, p.209). It views space as being selectively unique. Activities and objects (eg. cost, time, and diffusion of information) determine spatial boundaries between interacting phenomena by varying their degrees of spatial intensity (Harvey, 1973, p. 209-211).

The region is currently viewed as a frame of reference, a mental image ranging from simple observation to abstract theory, producing varying degrees of generalization. These mental images view the earth as a braided quilt which results from varied but interrelated processes (James, 1972, p. 460-472).

In defining regions it is essential that the criteria involved be compatible. These criteria should be specific and limited in number as diversity of criteria may obscure the results (James, 1972, p. 270). James pointed out that the basic elements of location, distance, direction, and succession should be taken into account when determining regions (p. 462). He also stated that the final outcome of the regional boundaries will be determined by the derivatives of these elements. These derivatives include patterns of spatial arrangements, circulation of flows of goods and services, diffusion of innovation from sources, and accessibilities (p. 462). Finally, he stated that the region will be justified if it displays areal cohesiveness and clarifies the factors of the problem (James, 1952, p. 199).

Types or categories of regions which may be recognized and studied can range from the broadest type or world region to detailed small local regions. More specifically, James (1952) identified regions as geographic, chorographic, and topographic. In terms of geographic study, world regions are the largest divisions. These regions and their boundaries are determined on small scale maps. They are therefore highly generalized and do not permit distinct relationships between phenomena to be established with accuracy. Chorographic regions are areas of intermediate scale and size. These characteristics

permit fewer generalizations and a greater number of relationships to be established. The third and most detailed study is at the topographic level. Studies at this level use large scale maps; therefore, generalization is at a minimum and many spatial associations can be recognized and plotted with accuracy.

Within each of these categories, three regional divisions with observable patterns can be studied. The first division is the morphologic region, which is evolutionary in nature and generic in method of study. The second is the humanistic division that seeks regional unities to distinguish and define regional personalities. The approach to this type of study is openly subjective and psychological in methodology. The last division is the nodal or functional region, in which interaction between specific phenomena are studied through a scientific and systematic approach (Moss, 1979, p. 2).

Today there are two readily identifiable problems in defining the term 'region'. It has as yet no standard definition, and as time proceeds the region appears to become more and more complex. Recognition of these problems took place in 1954. This brought about the creation of a new discipline of study called regional science. This new field of study includes a conglomerate of scholars from various fields of study who are pooling their knowledge in an effort to better understand the internal and external complexities of the region (James, 1972, p. 522).

B. Regionalization in the Alaskan Context

The question might be asked, how do concepts of a region apply to the Alaska situation? A further question to take into consideration is: Why is regionalization important to the state?

As already mentioned, the region is an unique phenomenon. Its boundaries are defined in accordance with the specific criteria under investigation, and they vary in area and shape. One could consider Alaska as a whole, a political region to be studied, but it is too large and varied in physiography and socio-economic make-up to provide for the most part, a meaningful and useful framework for study. The alternative to this approach is to define homogeneous regions of the state which are smaller in area and provide for

a more meaningful analysis of data collection for administrative and planning purposes. This was the view of George Rogers in 1955 when he divided the state into three regions which he considered were the largest meaningful divisions of the state for planning purposes (Rogers, 1962). The following section describes several schemes which have used various criteria for regionalizing the state. Each region has its own distinct size and shape according to criteria used.

Physiographic Regions

Since the time it was acquired from Russia in 1867 through its earlier years as a United States possession[1], Alaska was not viewed positively by the general public. Attached to it were various derogatory terms such as "Seward's Folly" and "the ice box." Most of these terms reflected an assessment of Alaska as an isolated wasteland, not suited for permanent settlement.

This negative attitude can be seen through the lack of interest which the United States government displayed in exploring and surveying the territory. After Alaska's purchase some coastal surveys were conducted, but the great Interior remained unknown for some 30 years. Minor surveys were conducted between 1893 and 1898, but it was not until the latter year that the United States Geological Survey (U.S.G.S.) seriously started an active exploration and survey program of the Interior. This change of attitude can be attributed to George Carmack's discovery of gold in 1896 on the Klondike River in the Yukon (Brooks, 1906, p. 126). The work was organized largely on the physiographic framework of the territory.

Figure 2 shows the areas which the U.S.G.S. actively surveyed during the period 1898–1903. It can be seen from this map that the principal areas covered by survey crews during these years followed major water courses and included only areas adjacent to them. The exception to this was in 1902 when a survey party ran a transverse from south Alaska to the Yukon River. It should also be noted that in 1900 the U.S.G.S. did not send out survey parties. The reason was that recent gold discoveries created such a

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[1] Alaska was purchased from Russia in 1867. From this time to 1877 the United States War Department was its governing body. From 1877 to 1879 this responsibility was transferred to the Treasury Department. Then from 1879 to 1884 the United States Department of the Navy was in charge of Alaskan affairs. Alaska, in 1884, became a district and remained as such until 1912 when it became a territory. In 1959 Alaska entered statehood.

demand for maps that they had all they could do to keep up the supply.

In other surveys, new areas were explored. In 1898, the Kuskokwim, Copper, and Susitna Rivers were surveyed. In 1899, surveying and exploration took place from the Yukon River north to the Koyukuk River. Finally in 1901, parties were deployed from the Yukon River into the Koyuk and Kobuk Rivers and also along the Arctic Ocean and Kotzebue Sound area (Brooks, 1906, pp.126-130).

From this time to the 1940's, continued exploration and surveying was accomplished along river courses. Later as a complement to this system, survey parties using pack horses were utilized in traversing plateaus and low mountainous areas. But even after some 50 odd years of topographic and geologic surveys, much of the state was still unmapped (Wahrhaftig, 1965, p. 3). This all changed rapidly however with the advent of aerial photographic techniques and their application to the territory during World War II. Thus, by 1946 the first comprehensive topographic map of Alaska was completed. It was however, lacking in detail as its scale was 1:1,000,000 and it had contours only at every 305 meters (1,000 feet). Refinement of mapping since this production has however continued and now maps with much greater detail such as 1:63,360 with contour intervals of 15 and 30 meters (50 and 100 feet) are available for much of the state (Wahrhaftig, 1965, p. 3).

Because of the introduction of aerial photography for topographic mapping in Alaska and the great increase in available information obtained from it, Wahrhaftig developed a comprehensive physiographic division of Alaska. His work began in 1949 and continued for ten years. In determining these divisions he relied on the help of numerous geologists and other scientists plus private institutions for assistance and advice. The end result of this study divided Alaska into twelve major physiographic provinces and some 60 smaller divisions. The terminology he used for this division was the same as that of "Fenneman and others (1946), in which the great physiographic features of North America were broken into major divisions, each major division into provinces, and each province into sections." (Wahrhaftig, 1965, p. 3). In Alaska, sometimes sections were divided into sub-sections. This divisional scheme of physiographic provinces and their sub-divisions is shown in Figure 3.

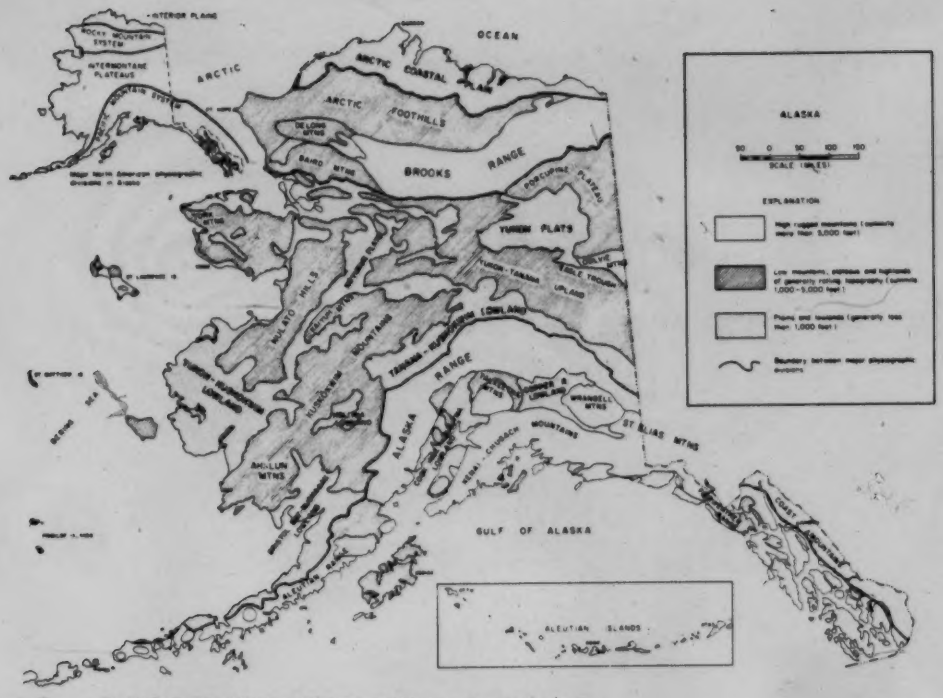

Figure 3 PHYSIOGRAPHIC PROVINCES OF ALASKA
Source: U.S. Geological Survey, 1964, as cited in Kresge, Moorehouse, &Rogers, 1977, p. 10.

Figure 4 JUDICIAL DIVISIONS OF ALASKA – 1910
Source: Redrafted from U.S. Department of the Interior, Thirteenth Census of the United States taken in the year 1910.

The purpose of this classification was twofold. First it was to divide the state into distinct topographic regions. Each of these regions was so unique that it could be physically separated by appearance and yet described easily through a short and accurate statement. Secondly, it was to aid in the analysis of the topographic and geologic history of Alaska (Wahrhaftig, 1965, p. 3).

Boundaries delineated by physiographic regionalizations have the innate ability also to serve as boundaries for other forms of regionalization. In Alaska this adaptability is the result of two major circumstances. First is the great diversity of landform regions within the state. Secondly, other regionalization schemes are able to select these boundaries on an unaltered or a modified basis. Although physiographic regions and their delineated boundaries are probably the most permanently fixed with respect to change, they are in general terms the most adaptable regional system one can find in that they are not in and of themselves the statistical factors on which socio-economic development is based. Thus if a regional socio-economic delineation which is based on a specific set of criteria extends its similiar characteristics over more than one physiographic region, these regions can in turn be combined to form the regional boundaries needed by the statistical data set being used. Because of this adaptability of boundaries this particular scheme is quite acceptable for incorporation into regional socio-economic regionalizations.

Socio-Economic Regions

Several good examples of early socio-economic regional divisions of Alaska can be seen by examining the United States Bureau of Census reports on population. These also reveal the changing pattern which has occurred in such divisions. From the first census count in 1880, these boundaries have changed numerous times.

The 1880 and 1890 censuses divided Alaska into six and seven districts respectively. The actual population counts were inaccurate and the data collected for reporting purposes were incomplete. Both censuses drew arbitrary boundaries (United States Department of the Interior, 1892; Petroff, 1884).

In 1900 the census again changed the boundaries for its purposes. This particular census acknowledged the fact that Alaska lacked well established civil divisions by which to assess changes in regional population and other socio-economic changes. Because of

previous inconsistencies in determining census boundaries, the census bureau simply divided Alaska in this census into two parts --a North District and a South District. As a division line, the east-west trending mountain range separating the Yukon and Kuskokwim Rivers was used (United States Census Office, 1902, p. CCXVI).

The 1910 census also divided Alaska differently. This time four districts were established. Each of these districts was further divided into enumeration areas each having a central town or village within it (United States Department of the Interior, 1913, p. 1128). There was however, for the first time some organizational unity to this census. This was due to the U.S. Government's action in March, 1909, which divided Alaska into four judicial districts (Tuttle, 1914, p. 100). These were further subdivided into recording districts equaling 42 minor civil divisions. These were divided into 108 secondary divisions comprising towns, villages, and settlements (United States Department of the Interior, 1913, p. 1134). From this time until Alaska's statehood, these judicial divisions served as the most universal framework of regional divisions including those of the census. These four divisions are shown in Figure 4 .

After statehood was achieved in 1959, the long established judicial divisions were abandoned in favor of newly created election districts which also were used for census purposes (Rogers, 1963, p. 2). At first there were 24 such districts. Each district was determined by two criteria--geography and population [9]. In 1960 the number of districts dropped to 19. This was due to population redistributions taking place in the state (Rogers, 1963, p. 2-3). In the census of 1970 the number of census divisions was increased again. This time there were 29 census divisions (See Figure 5.).

Finally, from the mid-1950's on, regional planning became a household word in the state. This created a need for further refinements of regional divisions which would assist in the collection and analysis of regional data for planning purposes. One such scheme of regional division which has gained wide acceptance today by federal, state, and private planning agencies is one which George Rogers created in 1962 (Kresge, Moorehouse, & Rogers, 1977). This regional division is shown in Figure 6. As with prior

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[9] The election district boundaries in reference to geography were determined on the basis of climate, natural resources, and physiographic characteristics such as mountain divides, watersheds, and islands, as in the case of Southeastern Alaska. Population distributions and concentrations were also considered with geography in determining the boundaries of these districts. A further note here is that the study of population is a specific field within geographic study, thus it is included as geography.

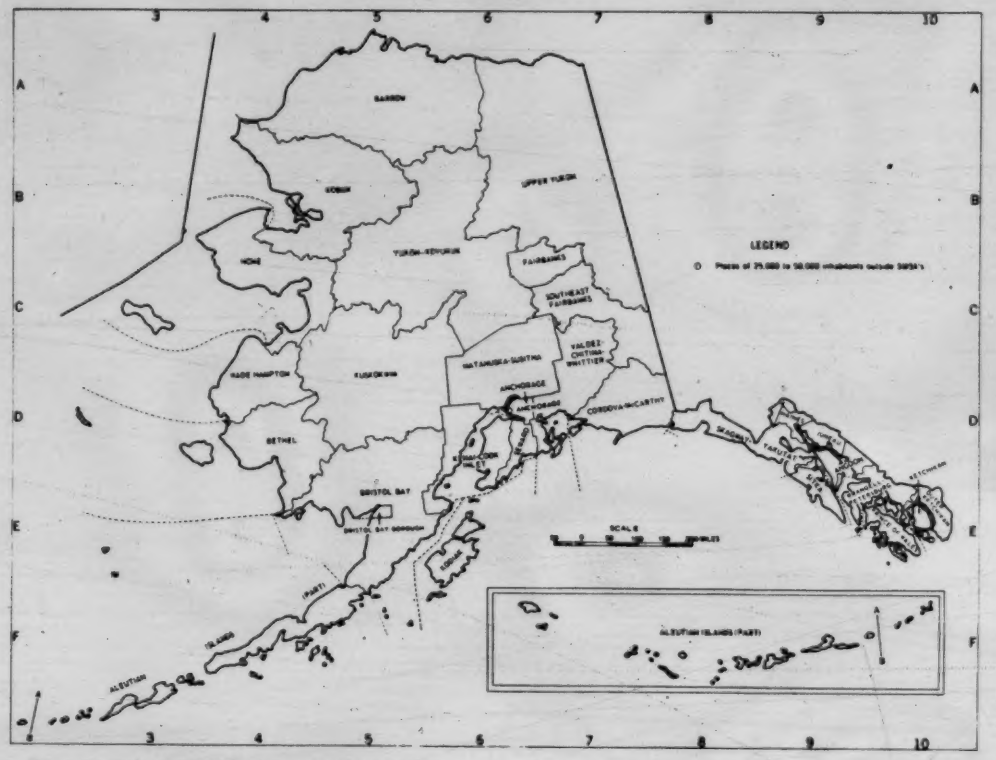

Figure 5 1970 Census Divisions
Source: 1970 Census of Population. U.S. Department of Commerce, 1973.

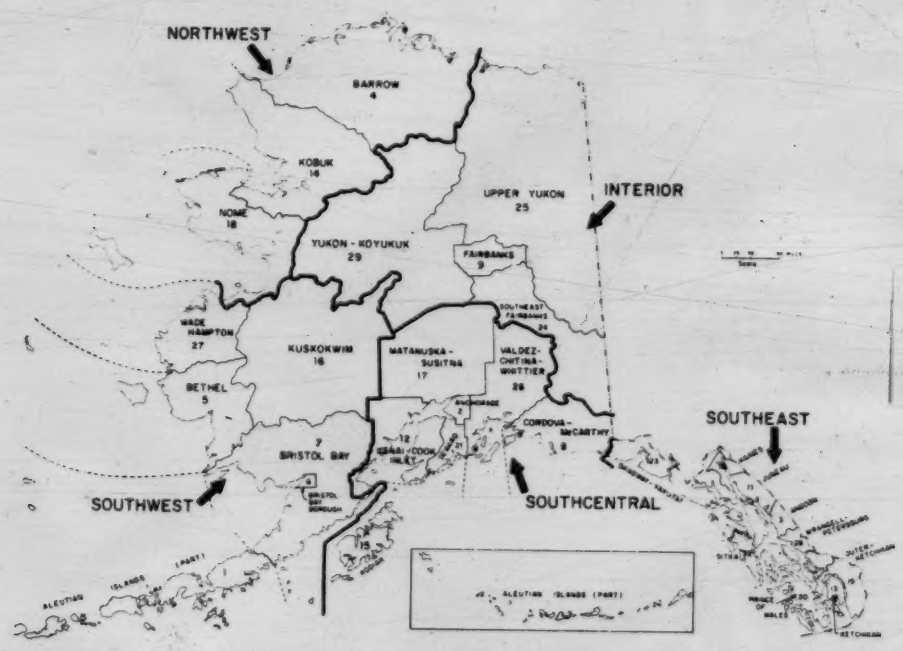

Figure 6 Regional divisions created by George Rogers in 1962.
Source: Kresge, Moorehouse, & Rogers, 1977, p. 12.

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regionalizations of the state, this study combined the concepts of homogenity and nodality (Rogers, 1967, p. 11). The purpose of this particular division was to provide a more meaningful and manageable division of the state and at the same time interfere as little as possible with existing divisional boundaries used for data gathering and administrative purposes.

In defining these five regions, Rogers was aware that he had to include specific characteristics and guidelines due to the makeup of existing regional units. He realized his new division had to be homogeneous, display social-economic interaction, and take into account physiographic features. Another consideration which had to be taken into account was the use of statistical data. Because U.S. census data for the state were incomplete and not always reliable, the regions had to be large enough to permit the incorporation of special statistical areas (eg. U.S. Bureau of Mines). He also knew that a region is dynamic. Each region derived therefore, should incorporate a major city within its boundaries to provide for interaction, and have natural resources which provide for present socio-economic growth and for potential future growth and expansion. Therefore, regions had to be large enough to provide for future internal expansion within the boundaries such that the latter would not have to be changed or modified as a result of subsequent growth. This would also permit statistical comparisions between regions to be made without interruption. A further characteristic of these five regions was that they could be combined to fit other existing statistical gathering units, thus enabling regional divisions to be adaptable to various special regional plans.

As a final note on these schemes of regional divisions and their boundaries a key phrase describing their relationship is "compatible-variability". In other words, divisions and their boundaries should in general be compatible with one another and with the particular study theme being undertaken at the time, but on the other hand, they must have the ability to transform with the changing circumstances through time.

Shape, size, and the number of regional divisions used in any one scheme appear to be related to three main criteria. These criteria are the type of study under consideration, the degree of relative importance and complexity placed upon the study for gathering and analyzing of data by the particular group or institution conducting it, and the topography of the area(s) under consideration.

It is the latter of these criteria which is of concern with respect to boundary determinations. In the case of Alaska, it is apparent that once earlier boundaries are determined they have the inherent ability to influence the geographic positioning of boundaries of subsequent studies which may be unrelated in focus.

Of special concern here are continental divides dictated by uninhabitable mountains for providing divisioned boundaries of the habitable lowlands. The questions to be asked here are do these boundaries adequately portray these regional interactions and do they place effective barriers to the flows of goods and services which are carried by airplane to nearly roadless areas?

Institutional Regionalization

Kirk Stone published a study in 1965 which distinguished zones of isolation in Alaska. The methods used in this study were previously developed and used by Stone during the 1950's when he was determining degrees of isolation in Scandinavia (Stone, 1965,p. 247). This Alaskan study was subsequently modified and used in a study by Rogers in 1967 on the need for and access to medical facilities in various regions of the state.

Stone's main concern which brought about this study in Alaska was that in northern lands a settlement policy is needed to help guide the advancement of settlement into fringe areas. (These are areas where settlement is sparse or nil.) Factors which stimulate the need for such policy are the lack of goods and services, and poor transportation facilities. Since these factors vary in availability from area to area, he used isolation as the key measurement for the advancement of settlers into fringe zones. This key measure was substantiated by hypothesizing that the farther the distance between two homesteads the greater the need for interaction or dependency between them (Stone, 1965,p. 248).

To determine degrees of isolation, he mapped two criteria or indices. The first one was population distribution. This was done by mapping the location of all permanently inhabited residences that were within a 2.4 kilometer (1.5 mile) radius of each other. There were two assumptions taken into account for this criterion. First, if medical aid or some other form of emergency help was needed, 4.8 kilometers (3 miles) was the

maximum walking distance residents could effectively cover to benefit from one another's aid. Secondly, the number of major directions in which neighbors were from one another was considered as an isolation indicator. In other words, the more directions there were neighbors within a 4.8 kilometer (3 mile) limit of a particular homestead, the less isolated it was. From the mapping of these two assumptions, four types of population distributions were developed (Stone, 1965,p. 248). These are shown in Figure 7.

The second index of isolation was determined by mapping existing transportation routes. The measure for this index was the number of directions a person could go within 16-32 kilometers (10-20 miles) of his home on a particular transportation mode to reach the transportation system. It is a measure of movement of people and goods and services into and out of an area. Four modes were represented: railroads, roads, water, and air. Each of these were further divided into inter-regional and local traffic. The characteristics of traffic subdivisions are as follows. Inter-regional traffic was assumed to be year-round traffic having all-weather bulk transport lines, service was direct and extra-regional on a regular and frequent basis. Local traffic was mainly bulk transportation on a seasonal basis (Stone, 1965,p. 248).

By mapping these two indices of population distribution and transportation accessibility, three identifiable regions and fringe settlement zones were distinguished. These zones are shown in Figure 8. The main divisions or regions of northern settlement are continuous settlement, discontinuous settlement, and unpopulated regions. The discontinuous region is further divided into four zones: inner, middle, outer, and outermost. Each of these zones displayed a particular type of population distribution as was discussed earlier.

Stone's final analysis found that there were no areas of continuous settlement and that more than 50% of the state was categorized under the outermost zone. This zone had a population distribution which he termed spotty.

A final comment on Stone's approach comes from Rogers in 1967. Rogers stated that this type of approach is a very useful one for planning purposes. Its only restriction is that it is criteria specific, as is the case with all policy-oriented approaches. Its main fault is that it can not be adapted to other planning schemes by changing criteria. If this is

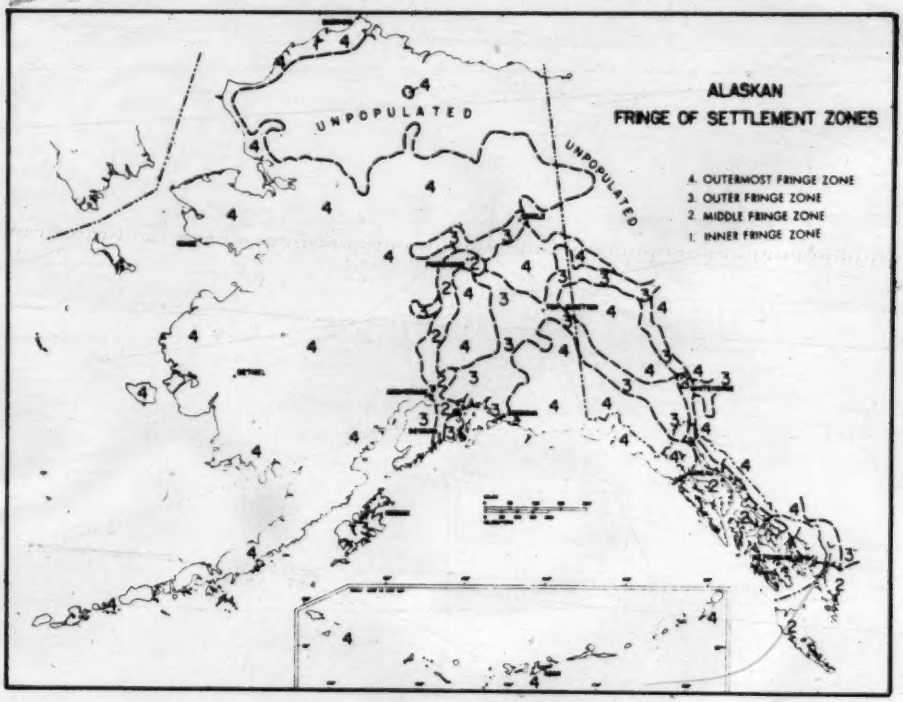

Figure 7 Settlement Zones established by K. Stone.
Source: Kirk Stone, 1965.

MEASURES OF ISOLATION

REGION, ZONE, TYPE	POPULATION DISTRIBUTION PATTERN	NUMBER OF ROUTES PROVIDING ACCESS*								SYNTHESIS: RELATIVE DEGREE OF ISOLATION	
		RAILROAD		ROAD		WATER		AIR			
POLEWARD		INTER-REGIONAL	LOCAL	INTER-REGIONAL	LOCAL	INTER-REGIONAL	LOCAL	INTER-REGIONAL	LOCAL	REGIONAL	LOCAL
UNPOPULATED	None (No population)	0	0	0	0	0	0	0	0	Very High	Very High
DISCONTINUOUS SETTLEMENT											
4. Outermost Fringe Zone										Very High	High
Inland Type	Spots	0	0	0	0	0	0-1s	0	0		
3. Outer Fringe Zone											
Inland Type	Clusters of Spots, Occasional Short Lines	0	0	0	1-2	0	0-1s	0	0-1	High	Moderate
Coastal Type		0	0	0	1-2s	0-1	1-3	0	0-1s		
2. Middle Fringe Zone											
Inland Type	Groups of Clusters, Short and Long Lines	0-1	1-2	0-1	2-3	0	0-1s	0-1	0-1	Moderate-Low	Low-Moderate
Coastal Type		0-1	0-1	0-1	1-3	1-3	1-4	0-3	0		
1. Inner Fringe Zone											
Inland Type	Interrupted Areas, Clusters of Groups	0-2	0-2	0-2	3-4	0	0-3s	0-1	0-1	Low	Low
Coastal Type		0-2	0-3	0-2	3-4	1s	1-4s	0-3	0-1		
CONTINUOUS SETTLEMENT	Uninterrupted Areas	1-2	2-4	1-3	3-4	0-3	0-4	0-3	0-4	Very Low	None

* Within approximately 10-20 English miles of each permanent resident

S- Only summer access on some or all routes.

Figure 8 Measurement of Settlement Isolation as determined by K. Stone.
Source: Kirk Stone, 1965.

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done its original concept is changed and it will lose its original meaning as a planning guide.

C. Alternatives for Regionalizing Alaska

In my opinion, too much attention in recent years has been placed upon socio-economic data pertaining to specific physiographic regions for planning purposes (eg. regional income, employment, and population data). While these criteria are useful for analysis and planning purposes, I believe that two other important criteria could help to define coincidence of regional boundaries to a greater degree: air transport flows and newspaper circulation. As mentioned earlier, regions are unique; so too is Alaska, especially in the realm of air transportation.

Rogers, in 1962, realized the importance of aviation as a regional stimulator for changing socio-economic conditions and regional boundaries, but as yet there is no regionalization scheme based on air transport flows. These flows are important as regional indicators mainly because much of the state is a roadless area and marine transport or freight is seasonal north of the Aleutian Islands; hence the importance of aviation as a lifeline supporter for existence in the outlying areas away from major centers. It is the prime mover of people, but more importantly, it is the supplier of goods and services via air mail and freight.

By determining air route structures, one can delimit a new set of regional boundaries. The importance of the delimitations would be twofold. First, it would serve as an alternate and new means for the collection and analysis of intra-regional data for monitoring present socio-economic growth and projecting future growth trends. Secondly, because route structures are inter-regional, two or more regions can be combined, enabling the state to monitor inter-regional growth via cross-flows. They could also be a determinant of growth pole development.

Newspaper circulation, the second indicator of regional trade boundaries, is another important criterion which has not been determined for the state, with the exceptions of Fairbanks and Anchorage. This criterion is an important indicator of

city-hinterland trade associations. It is also an indicator of an individual's preference towards a particular region with which he associates himself. Therefore, by determining the boundaries of newspaper circulation areas, one can gain a stronger insight as to how socio-economic and political aspects of a region are functionally tied.

D. Summary

In summary, regions and how they have been described and used have varied through time. Two common threads of the 'complex quilt' which constitute a region are uniqueness with respect to phenomena under consideration, and the elements used to determine regions; namely, distance, direction, location, and succession. These elements have been used for centuries.

Apart from these commonalities, the region has been seen from two different perspectives. The earlier Kantian theory saw the region as an absolute whole which was based on static locations and whose boundaries were measured by Euclidean geometry. The other school of thought viewed regions as relativistic, The main theme here was that objects and events determine regional divisions. Those phenomena are dynamic in nature, that is, they display varying degrees of fields and forces which interact with one another to create different boundaries. Another characteristic of the relativistic view is that these phenomena must be measured by non-Ecludian geometry (eg. cost and time).

Currently, regions are still being philosophically discussed, but it appears scholars have recognized that as time and technology advance and as population grows, regions become more complex. It is for these reasons that a new branch of scientific study has evolved. This is the field of regional science. Its main purpose is to find new methods to analyze these complex regions through a pooling of interdisciplinary knowledge.

In turning to Alaska, physiographic divisions are probably the oldest and currently most widely used boundaries for regionalization. River basins and mountains have been the most common denominator. Prior to the introduction of aerial photography, divisions were quite simple with surveying taking place in coastal areas and along major river courses. With the advent in the mid-40's of aerial photography, however, surveying

became much more speedy and complex. This resulted in more accurate and abundant data sets to work with and as a result more complex physiographic divisions.

Socio-economic divisions bear a strong link to physiographic regions. Early census counts used these divisions quite extensively in determining arbitrary census regions. Today when determining and studying socio-economics, physiography still exerts a strong influencing force in boundary demarcations. This is mainly due to strong man-land relationships in the Alaskan environment where nearly every major physiographic division is tied to specific types of socio-economic conditions.

Lastly, the institutionally derived region, a policy orientation approach, was described some 16 years ago and is still a valid concept in the Alaskan setting. Most of rural Alaska is still isolated. Transportation (with the exception of a few road extensions, and increased air services), has not been significantly expanded. There are no roads or railroads, for all intents and purposes, connecting urban and rural Alaska[10]. Thus, Professor Stone's criteria of direction, distance, and number of transport modes available, is still applicable to a study of services available and the time involved to reach or receive such goods and services is still significant.

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[10] The exceptions here are the public corridors which connect Anchorage with the Kenai Peninsula to the south, and with Fairbanks to the north. There are also roads from both Anchorage and Fairbanks which lead to the "lower 48" states, as well as local roads around various centers in the state. This total mileage as of 1980 is approximately 17,800 kilometers (11,000 miles). Railroad total track mileage is 760 kilometers (470 miles).

III. The Description and Delineation of Newspaper Circulation Boundaries

A. The Importance of Newspapers as a Regional Indicator

There are numerous reasons why newspapers are an important indicator of city-hinterland bondages, and therefore why they are good indicators of regionalism. In broad terms, the newspaper is an index of the organizational structure of economic, social, and political functions which interact to form a metropolitan region.

As an economic indicator of regional trade boundaries, newspapers are first of all a commodity which is produced, distributed, and sold (McKenzie, 1933). Therefore, newspapers establish a market through a buyer-seller, seller-buyer interaction which mutually satisfies both parties involved. To help create and strengthen this market, newspaper advertising helps by establishing a closer rapport between services and goods offered in a center, and the users and potential users of these goods and services in neighboring rural areas (Johnson, 1972). As a final note, newspaper boundaries closely approximate the commuting and shopping patterns of a metropolitan area (Preston, 1979).

Newspapers also are important as a social indicator. They reflect the existence of social organizations, groups, and institutions, all of which help to create stronger social ties between people in the region. The newspaper is a medium which helps to promote and focus a sense of community (Smailes, 1968).

Politically the paper is a disseminator of local, regional, and national news . This builds public opinion in the community and helps to engender public awareness and response (Yeates & Garner, 1971).

B. Studies That Have Used Newspaper Circulations as Regional Indicators

Studies which have emphasized the importance of newspaper circulation as an indicator of retail trade boundaries include: Reilly (1929), Park & Newcomb in Mckenzie (1933), Haughton (1950), Bracey (1953), Green (1955), and Smailes (1968). All these studies were concerned with newspaper circulations as indicators of city-hinterland

regional boundaries. An important conclusion derived from the studies by these geographers was that zones of influence which were created by nearby centers did in fact exist. Other factors which were found to be influential on the trade zone boundaries were size of the competing centers and the distance the competing centers were from one another.

From these studies, various terms were used to describe the regional boundaries identified. Such terms included overlapping, enclaves, vacuum, intensive, extensive, and fringe. Johnson (1972, p. 87) emphasized, however, that the specific terminology used is not extremely important as long as one realizes that it is not an exact description of the relationship of the city or town to the hinterland.

Green (1955) differed somewhat in his study from the others who concentrated on newspapers; he instead claimed that other economic indicators such as transportation, communications, agriculture, recreation, finance, and manufacturing were also important in delimiting city-hinterland trade boundaries. In his study of the New York-Boston hinterlands, he found that each of these indicators had its own individual trade area boundaries. By combining these varied boundaries, he then produced a mean boundary to describe the trade area.

C. Criteria Used for Selecting Cities

In selecting Anchorage, Fairbanks, Juneau, Ketchikan, Nome, and Bethel as the appropriate centers of retail trade for this study, several factors were considered. First, they are the largest population centers of the state which have operating newspapers. Secondly, they are situated areally in a manner that permits a relatively continuous linear southeast-northwest evaluation of news circulation coverage on a statewide basis. Thirdly, their individual geographic locations are such that all major economic regions of the state are represented. These regions, as defined by the Alaska Department of Labor, Employment-Security Division, and their respective cities include the Southeast region where Ketchikan represents the extreme southern portion and Juneau the northern part; South Central where Anchorage is located; the Interior and its major city of Fairbanks;

Northwest Alaska containing within its boundaries the city of Nome; and Southwest Alaska represented by Bethel. A fourth factor is that each of these cities is the socio-economic and transport center of its respective region. Finally, they all have functioning federal, state, and local regional offices in operation, which gives them political representation.

Circulation data used in the analysis of the Anchorage and Fairbanks trade regions will not total exactly 100%. The reason for this situation is that the ABC Audit Report--Newspaper (Audit Bureau of Circulation, 1975) does not list specific places in its reports if the total number of individual copies sent to these places is less than 25. Instead, they list only census divisions and the number of copies which are distributed within them. Therefore, these miscellaneous copies have not been included in this analysis, except in Table 1 where total circulations are shown. These miscellaneous copies account for 514 or 1.1 % of the Anchorage Times' circulation and for .08 % of the Fairbanks Daily News-Miner's total. It can be further assumed that since these copies are not circulated within the publishing city itself that they are, in fact, rural and that the receivers are located in the smaller isolated settlements within the trade region.

A further adjustment also was made in the Fairbanks Daily News-Miner's total circulation. This adjustment was necessary because the Alaska pipeline was under construction at the time. Since papers were being sent to non-permanent construction camps, it was decided to exclude these totals from the Miner's total circulation count.

Circulation totals for the remaining newspapers will equal 100 per cent of the circulation as was listed in the returned newspaper surveys, except for the Southeast Alaska Empire of Juneau. Here again total circulation and city circulation are given but the rural areas are shown in Table 6 as having only 310 copies circulated. This is in contrast to the 528 copies listed in the total circulation breakdown as shown in Table 1. Therefore the rural circulation analysis of Juneau represents 59 per cent of the total rural circulation in this analysis. This situation is a result of the newspaper listing its total circulation figures, but not listing all rural places receiving issues of the paper.

Table 1

Circulation Data for Selected Alaskan Newspapers 1974-75

Name of Newspaper	Frequency of Circulation	Total Circulation per Edition	Number of Circulations per Edition Distributed Within Publication Settlement	Number of Circulations per Edition Distributed to Rural Settlements	Publication Settlement Circulation as a Percentage of Total Circulation
Southeast Alaska Empire (Juneau)	Daily	5013	4485	528	89.5
Ketchikan Daily News	Daily	3693	2724	969	73.8
Nome Nugget	Tri-weekly	982	400	582	40.7
Tundra Drums (Bethel)	Bi-Monthly	2,500	2,140	360	85.6
Fairbanks Daily News-Miner	Daily	14,760	11,698*	3,062**	79.3
Anchorage Daily Times	Daily	46,293	38,558	7,735	83.3

*This number was adjusted to delete pipeline camps which are non-permanent settlements. Actual gross total circulation was 15,567.

**This figure combines city and rural route deliveries. The latter number represents 2,057 of the total circulations. If rural route deliveries were not included in this total, city circulation would be only 65.2%.

Source: Data pertaining to Anchorage and Fairbanks was extracted from the ABC Audit Report-Newspapers. The remaining data was extracted from survey questionnaires.

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D. Actual Boundary Delineation

To delineate the actual boundaries of selected newspapers in Alaska, information was acquired from two sources. First was the ABC Audit Report-Newspaper (Audit Bureau of Circulation, 1975) for the cities of Anchorage and Fairbanks. Secondly, because this report is not published for other Alaskan cities, a questionnaire was developed and sent to the newspaper publishers in the cities of Juneau, Ketchikan, Nome, and Bethel. Two questionnaire forms and excerpts from the ABC Audit Report are attached as Appendices A, B, and C[11].

From this collected data base the material was then put into tabular form for each newspaper in the study. Each table contained information about the places served by the newspaper, the amount of circulation received by each place, the population of the receiving settlement, and the distance it is from the publishing center.

The outside circulation was termed rural and unless otherwise stated means the total outside circulation including inter-regional and inter-state circulations. In calculating rural percentages of newspaper flows intra-city circulations were omitted. This data separation permitted an easier and more meaningful analysis of the data base and also permitted a clearer comprehension of the data.

As a measurement of market isolation and/or penetration, the ratio of copies per issue received by each settlement was analyzed and ranked. Settlements that received less than one percent of the rural circulation were not included in the calculations. The settlements which displayed the highest percentage scores were those which were not penetrated as fully as those that received a lower rank and therefore can be considered more isolated. Specific reasons as to why they were ranked as they were, are not given by this indexing. There could be many factors involved such as literacy rates, age and sex ratios, political apathy, frequency of mail service, income per capita, and the degree of subsistence used to supplement the cash economy system for a livelihood.

Distances between the sending and publishing centers were used first to

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[11] The first questionnaire form attached as Appendix A was the original test form which was sent to four cities which were not included in my survey. From this form corrections were made so as to produce desired responses from the participants in the final survey draft which is attached as Appendix B. Excerpts from the ABC Audit Report-Newspapers are shown as Appendix C.

determine the outer trade zone boundaries of each newspaper's region[12]. Secondly, they were used for determining the mean distance boundaries for the inner trade zone of each newspaper's trade area[13]. With respect to the mean distance boundary line, it was deliberately chosen for two reasons. First, it shows the areal extent of which 50% of the population lies within the total trade area, and secondly, since it delineates the newspaper trade area via distances in nearly roadless areas it is assumed to be a good indicator of scheduled air route boundaries which are considered in Chapter IV. Two factors were assumed in these calculations. First, it was assumed that all distances are straight line measurements, and secondly, it was assumed that the distance from any one point to any other point is the shortest distance. These assumptions were made due to the fact that air transport is the main mode of travel in these nearly roadless areas. Because of these factors, the market areas will be circular and assumed as a perfect plane. Anchorage and Fairbanks are exceptions in this delineation of outer boundaries because the Audit Bureau of Circulation (ABC) already has determined their extent by using census division boundaries.

It should be noted at this time that within the theoretical circular marketing boundaries, the population distribution is not uniform. There can be sectors within each regional trade area that have all, little, or none of the population from which the regional center can capture trade. If these boundaries were delineated to show a more concise portrait of the marketing areas through the analysis of population densities and newspaper circulation percentages associated with these densities, they would have varied in both size and shape This type of regional analysis was not, however, included in the intent of this particular study. The maximum spatial extents of retail trade for the zones was believed to be a better indicator of regionalization for socio-economic planning. Therefore, if a more detailed sectoral analysis of a particular trade zone is wanted, reference must be made to the appropriate map and figure for determination of

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[12]This trade zone is considered to be the weakest area of retail trade interaction within the regional center's trade area. The boundary line of this zone was chosen to delineate the maximum areal extent of this retail trade zone. Secondly, it should serve as a good indicator of the maximum areal extent of scheduled airline service to and from the regional center.

[13] The "inner trade zone" is defined as the area surrounding the publishing center. The maximum distance which this zone areally extends into the center's hinterland is determined by one of two criteria. These are the mean distance and 50% circulation boundaries. Either one of these boundaries may represent the zone's outermost distant boundary.

where the population concentrations are located and what percentage of the newspaper circulations these concentrations represent.

A second inner zone boundary was also determined by approximating the area at which 50% rural circulation coverage was achieved for a city's newspaper. This index was thought to be a good arbitrarily derived indicator of newspaper readership and interacting retail trade activity between the reading public and the sending regional center. By combining this boundary with the mean distance line, two inner zone boundaries of newspaper circulation were defined. This band of mean circulation was used in this analysis to provide for fluctuation in degree and intensity at the outer edge of the inner zone. This was done in recognition of the fact that no one line is static or fixed in nature, and that this would be particularly true in an area where interacting is or could be greatest and/or weakest. Therefore this banded area represents the area of greatest zonal fluctuation in which two cities compete for trade. It could also represent the area where the regional city is trying to expand its regional dominance in a transitional area.

Reilly's Law of Retail Gravitation

In this study the particular theoretical methodology called the breaking-point formula was used to delineate the selected newspaper circulation boundaries for the state of Alaska. This formula was derived from Reilly's 1929 study of retail relationships. In this study he examined newspaper interaction between 419 Texas settlements[14]. His final analysis indicated that he could determine within five percent accuracy the amount of retail trade a large city capitalizes on in a smaller place (McKenzie, 1933). This retail relationship, Reilly called, "the law of retail gravitation", and to determine the interaction between places he used a breaking-point formula which was derived from it. His law of gravitation states that:

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[14] Although the formula derived from Reilly's law was applied to an area where roads were common place, the formula's use in the Alaskan context reflects its effectiveness in three different situations. There are areas where roads do exist between major centers (eg. Anchorage and Fairbanks). There are areas where roads are restricted to a more local character connecting small towns to the regional centers (eg. Juneau and Ketchikan regions). Finally, there are areas where roads are nearly non-existent (eg. Bethel and Nome regions). The point here is that the formula derived from Reilly's law can be tested for its accuracy in all three different situations.

"Two cities attract retail trade from any intermediate city or town in the vicinity of the "breaking-point" approximately in direct proportion to the population of the two cities and in inverse proportion to the square of the distances from these two cities to the intermediate town" (Berry, 1968, p. 16).

The derived breaking-point formula which is used in this study is stated as follows:

$$\text{Breaking point from City A} = \frac{\text{Distance between A \& B}}{1 + \sqrt{\frac{\text{Population B}}{\text{Population A}}}}$$

where A and B are competing cities,

D is the distance between the cities,

and P is the population of Cities A and B

(Yeates & Garner, 1971, p. 103).

There have been, as with most if not all methodologies, both positive and negative attitudes and comments expressed by various researchers as to the applicability of a particular method as a research technique for a given topic. Some of the criticisms of Reilly's law are as follows. It does not explain why observed regularities occur. That it draws on the field of physics to explain human behavior, is a second criticism. Thirdly, it is a static and descriptive technique: it does not admit that there are more than two places in competition for the same trade area. A further criticism is the belief that consumers will favor the closest center from which to obtain goods and services from the tertiary sector. Finally, there are two specific problems associated with the use of Reilly's formula. These are the weighting exponent of distance and the variations in population between the cities used in determining the breaking-point. Both of these problems were encountered during this study and are mentioned later in this chapter. On the whole, however, the formula was found to work well in its unmodified state.

In spite of these criticisms, the law of retail gravitation is a quick, easy and accurate method to use in determining the trade areas between cities. Berry points this out by stating that Reilly's law still "remains a good approximation for studying retail trade relationships even today" (Berry, 1968, p. 17).

A General Description of the Physiographic and Transport Modes Contained Within the Total Newspaper Retail Trade Regions of Anchorage and Fairbanks

The area of coverage by the circulation of The Anchorage Daily Times and the Fairbanks Daily News-Miner is in essence the whole state (See Figure 9.). Exceptions to this are the Aleutian Islands, Bethel, Kuskokwim, and Wade Hampton census divisions and the census division of 'Southeastern' Alaska. It should be pointed out, however, that in most cases there are a small number of papers going to these divisions from one or the other of these newspapers. Because of this wide area of coverage, these papers could be better termed inter-regional papers. Due to this extensive coverage, only a brief general description will be given of the physiographic characteristics and transport linkages that are included within the total area of these newspaper regions.

Physiographically, the Anchorage area's outer newspaper boundary is bounded on the north by the Alaska Range. The inner portion of this arc contains several minor mountain ranges and contains two major river valleys, the Matanuska Valley to the north of Anchorage and the Copper River Valley to the northeast of the city.

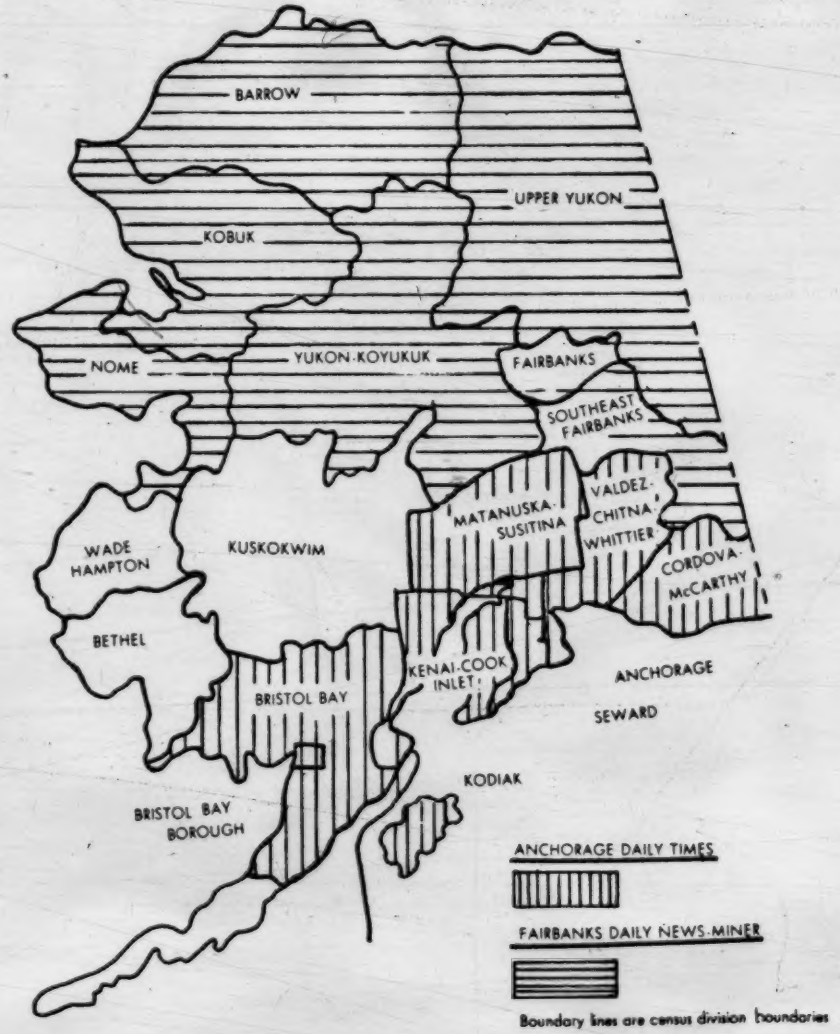
For the most part, the Alaska Range is a formidable barrier. It is crossed by two roads and one railroad which provide for external land linkages to and from the region. To the north one road and a paralleling railroad extend for a distance of 708 kilometers (440 miles) connecting the cities of Anchorage and Fairbanks. These two routes are the major ground links between the two trade regions. The second road from Anchorage heads northeast across the Talkeetna Mountain to Tok Junction, where one has the option to drive north to Fairbanks, east to Dawson City, Yukon Territory, or south to the 'lower 48'. Between Anchorage and Tok Junction at a settlement called Glennallen, another important road leads south to the city of Valdez and north to Fairbanks.

To the south of Anchorage, the Kenai Peninsula contains low flat lands in its western part and to the east, a mountainous area. There are two main roads in the Peninsula which connect with Anchorage. There is also a railroad which parallels one of these main roads to the city of Seward. The second road services the cities of Kenai and Homer.

The Fairbanks newspaper trade region which is north of the Alaska Range also is bounded on the south by the Alaska Range. To the north of Fairbanks is the Yukon River

FIGURE 9

RETAIL TRADE REGIONS OF THE ANCHORAGE TIMES AND THE FAIRBANKS DAILY NEWS-MINER 1974



Source: A.B.C. Audit Report Newspapers

and the Brooks Range. The latter separates Arctic Alaska from the Interior. There is one major road which travels north into the oil-rich North Slope, but the general public is only allowed to travel to the foothills of the Brooks Range, therefore the road is mainly for commercial industrial users. There are also three roads of minor importance; one leads to the village of Circle, on the Yukon River, another leads to the small village of Manley Hot Springs, and the third to the settlement of Chena Hot Springs. The two major highways and the railroad leading south from Fairbanks have already been mentioned.

The Anchorage Times Trade Area

The Anchorage Times' outer circulation boundary, as shown in Figure 9, includes eight census divisions which are as follows: the Anchorage, Bristol Bay, Cordova-McCarthy, Kenai-Cook Inlet, Kodiak, Matanuska-Susitna, Seward, and Valdez-Chitna-Whittier divisions. Also included are the Bristol Bay and Kenai Boroughs. In total the population of these divisions is 166,673, and of this total the City of Anchorage represents 42,582 or 26%. It is also noteworthy that four of these eight divisions receive their newspapers exclusively via air because a short delivery time is important. Within these four divisions (the Bristol Bay, Kodiak, and Cordova-McCarthy divisions, and the Bristol Bay Borough),there are 35 settlements with a combined population of 15,898 or 10% of the total trade area's population. Other settlements in other census divisions also receive their newspapers via air mail when same day service is needed because distances are very long and surface travel times are too great.

The northernmost extremity of the Times' retail trade boundary is the Matanuska-Susitna census division which is 483 kilometers (300 miles) from Anchorage. This northern boundary then arcs east and west to tidewater. The eastern boundary is the northern census division lines of the Valdez-Chitna-Whittier and Cordova-McCarthy divisions. The maximum distance here is 354 kilometers (220 miles). From Anchorage, the western extent of the trade region follows the northern division lines of the Kenai-Cook Inlet and the Bristol Bay divisions. The westernmost point is 483 kilometers (300 miles) from Anchorage. Instead of determining a possibly more accurate and unique boundary to conform with their specific usage, it is interesting to note here that the ABC appears to have opted in favor of the use of pre-existing census boundaries which in turn

themselves were determined by the Alaska Range, a physiographic feature. The point here is that once a boundary has been established there appears to be a strong resistance against its change, even though the change may be beneficial for socio-economic, political, or other forms of planning.

The population contained within this trade region is 166,673. The most populous census division within this region is the Anchorage division which had a population of 124,542. This amounts to 75% of the trade region's total population.

To determine what percentage of the population in the Anchorage area is urban as opposed to rural, it was decided to consider as urban the Statistical Metropolitan Area (as defined by the 1970 United States Census Bureau). This includes Birchwood, Spenard, and Sand Lake, as well as the Elmendorf Air Force Base and Fort Richardson. The reason for these inclusions is that they are all large built up areas which are juxtaposed to the city's boundaries. These additions increase the city's population to 87,606 or 53% of the total trade region population. This leaves the region with a total rural population of 79,067 of which 32,446 are found in settlements consisting of villages, towns, and cities. This latter figure represents 39% of the trade region's rural population. The remaining 61% is thus rural homesteads, or places with less than 25 inhabitants.

Settlements within the region number 84 excluding those listed with Anchorage. Settlements in this region also vary in their population sizes more than in any other region of the state, the smallest settlement having less than 25 inhabitants and the largest being the City of Anchorage[15].

By grouping settlements of less than a thousand population into increments of 100, it was found that the most common grouping was the less than 25 to 99 category. There were 39 such settlements which account for 42% of the region's total places. Population-wise this group represented 2.6% of the region's total population. The second most populous grouping was the 100-199 group. This group represented another 17 settlements or 20% of the region's places and contained 3% of the total population. The

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[15] The term "settlement" in this thesis has more than one meaning. When it is used in conjunction with United States Census data for total borough population, it includes all places of permanent inhabitants, that is from a single dwelling to the largest city. When "settlement" is used in conjunction with ABC Audit Reports and rural settlements, it refers to cities, towns, and villages with a minimum population base of 25 inhabitants. Rural homesteads, on the other hand, refers to all unincorporated places with less than 25 inhabitants.

remaining settlements in this size grouping accounted for another 18 settlements with 8.6% of the region's population. In combination the two most prevalent size categories contain 62% of the region's settlements but only 5.6% of the total population base. Of the total 70 settlements of less than a thousand population, only 11 are listed in the ABC (Audit Bureau of Circulation, 1975) as receiving newspapers, but it must be remembered that if a place receives less than 25 copies per issue, it does not list the individual receiving settlement. These 11 settlements within the region received 477 copies per issue or 6% of the Time's circulation.

The third group of settlements were those in the 1,000-1,999 category. These settlements total six in number of which all are represented by the ABC as receiving copies. These settlements represented 10.6% of the total population and account for 43% of the region's paper circulations. The remaining settlement groups were those in the 2,000-2,999 and 3,000-3,999 groups. Eagle River was the one settlement representing the 2,000-2,999 grouping. It was the largest rural receiver of the Times' circulation. It received 1,841 copies per edition. This number represents 23.8% of the total rural circulation and 30% of the regional total. Two of the three settlements in the 3,000 group were listed in the ABC (Audit Bureau of Circulation, 1975) as receiving 1,298 or 21% of the regional circulation. The third settlement, the Kodiak Island Naval Station, was not listed. Combining these latter two groups, they represent 16% of the region's population and received 51% of the region's circulation.

Also noticeable from the Anchorage data in Table 2 is that 947 papers or 13% of the total rural circulation was inter-regional and inter-state coverage. The former accounted for 585 papers or 8.1% of the rural circulation and the latter received 438 papers or 6% of the total. Fairbanks was the largest inter-regional reciever of Anchorage papers. It received 212 papers per edition. This amounts to 2.9% of the total rural circulation and 36% of the inter-regional total. The second highest receiver of inter-regional papers was Juneau. It received 98 papers or 16.7% of the total regional circulation. As for the 'lower 48', the state of Washington received 1.6% of the rural circulation. The city of Seattle received 71 of these papers or 62% of Washington's circulation.

Table 2

Newspaper Circulation Data for The Anchorage Times 1974-75

Name of Receiving Settlement	Number of Newspapers Circulated per Issue	Population of Receiving Settlement	Ratio Index of Newspaper Readership Persons/paper*	Distance Between Receiving Center and Anchorage (Miles)
Eagle River	1,841	2,437	1.3	12
Palmer	1,243	1,140	0.9	37
Kenai	749	3,533	4.7	65
Valdez	556	1,005	1.8	118
Kodiak	549	3,798	6.9	255
Soldotna	435	1,202	2.8	63
Fairbanks	212	14,771		270
Seward	196	1,587	8.1	76
Homer	150	1,083	7.2	122
Glenallen	107	363	3.4	155
Cordova	100	1,164	11.6	147
Juneau	98	6,050		573
Dillingham	67	914	13.6	
Nome	64	2,488		540
Kotzebue		1,696		550
Adak	55	2,249		1,195
Bethel	51	2,416		400
Copper Center	31	206	6.6	158
Seldovia	31	437	14.1	138
Talkeetna	31	182	5.8	78
King Salmon	30	202	6.7	345
Petersburg	29	2,042		688
Wasilla	29	300	7.7	28
Willow	26	38	1.5	40
McKinley Park	25	<25	1.0	175
Haines	15	413		512
Yakutat	5	190		365

Out-of-State Circulation

Washington 115
Seattle 71
All other states 323

*Ratios listed are only those for cities within the newspaper circulation trade area. Ratios higher than 50 readers per paper have been excluded.

Source ABC-Audit Report-Newspapers, 1975.

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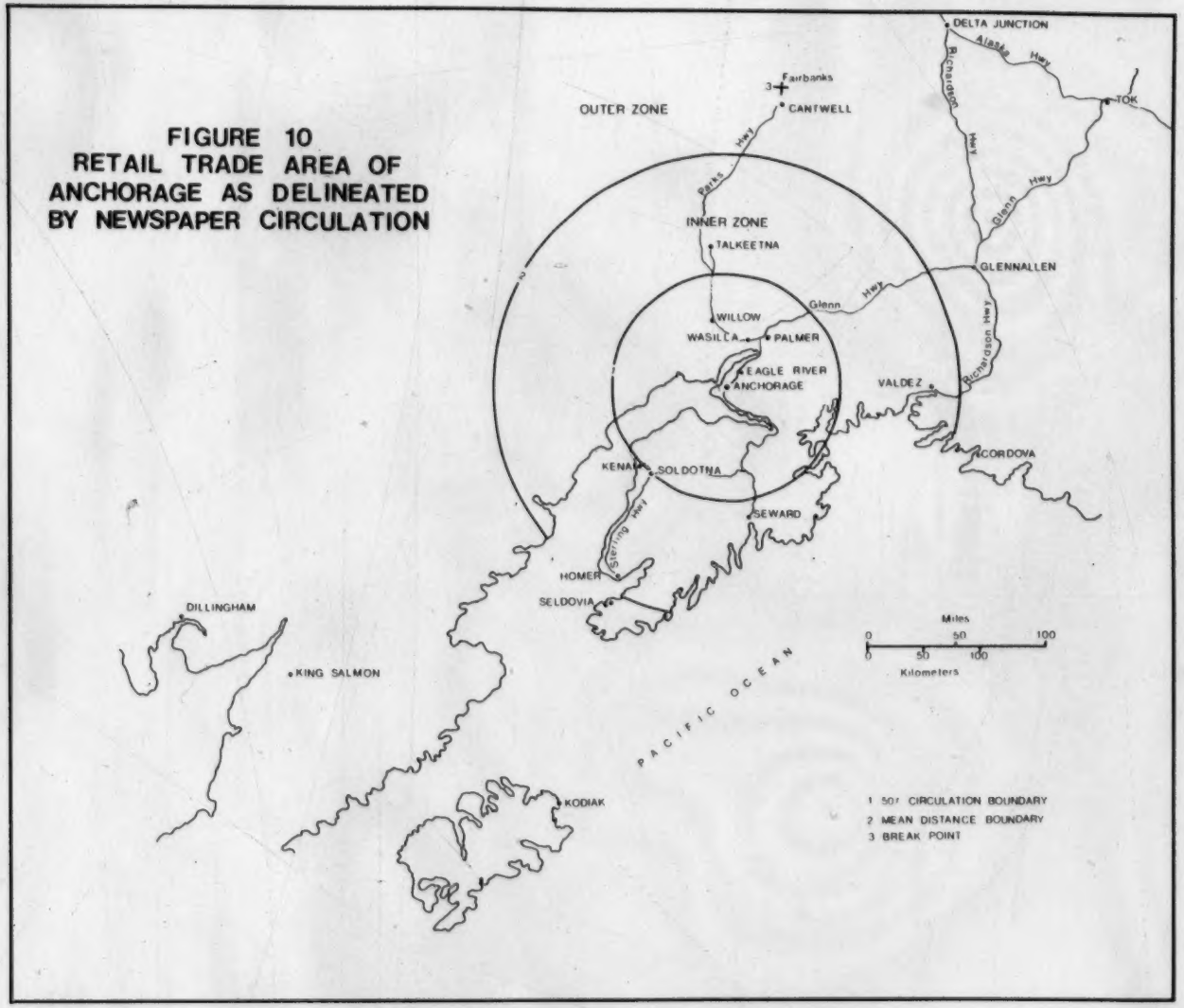
FIGURE 10
RETAIL TRADE AREA OF ANCHORAGE AS DELINEATED BY NEWSPAPER CIRCULATION



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For the Anchorage trade region, the ratio index of newspaper readership [16] ranged from a high of 14 persons per paper in Seldovia to a low of .917 for Palmer. The mean village readership for the area was 5.88 which is the best ratio of all papers analyzed. The very low ratio for Palmer is a good indicator of its importance as both a collector and disseminator of the Anchorage paper to the rural countryside.

In establishing the inner trade zone boundaries of the Times' trade region, the mean distance boundary was determined at 209 kilometers (130 miles) from Anchorage. The 50% coverage area was located at a distance of 101 kilometers (63 miles) from the city. The extensiveness of the former boundary is caused by three cities (i.e. Dillingham, King Salmon, Kodiak) which are extraneous, or distance isolates from the region proper, as they are more than 160.9 kilometers (100 miles) from the main grouping of cities. They are, however, part of the subscribing region and thus strengthen the areal extent of the trade region.

By applying Reilly's formula to the Anchorage Fairbanks corridor the break-point is located at a distance of 273.5 kilometers (170 miles) from Anchorage or exactly at the ABC pre-determined retail trade boundary. Figure 10 and Figure 17 display these trade areas.

The Fairbanks Daily News-Miner Trade Area

The Fairbanks News-Miner trade area, like that of Anchorage, is a very extensive area with a very small and isolated population (See Figure 9). It encompasses seven census divisions which when combined have a total population of 69,325. These census divisions are the Barrow, Kobuk, Upper Yukon, Yukon , Southeast Fairbanks, Fairbanks, and Nome census divisions. A general overview of the physiographic characteristics of this trade region from north to south includes an arctic plain and foothills region to the north of the major east-west lying Brooks Range. South of this range there are numerous hilly sections interspersed with valleys. These valleys vary greatly in size, the

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[16] This is a ratio which relates the number of newspapers sent to a place to the number of inhabitants residing in that place. The ratio is equal to the number of people per paper sent to a settlement. A low ratio indicates a high readership within the settlement.

largest of which are the Tanana Valley and the Yukon River Valley . South of the Tanana Valley lies the foothills of the Alaska Range, which is the southernmost boundary of the trade region.

Again as with the Anchorage region, the Fairbanks census division contains the majority of the population in the trade region. This number is 45,864 or 66% of the region's total population. As with Anchorage, the surrounding urban areas juxtaposed to the Fairbanks city limits have been included with the city's population. These areas are Aurora-Johnston, College, Ester, Graehl, Lemeta, North Pole, South Bjerremark and Fort Wainwright. With these inclusions the circulation area of Fairbanks has a population base of 31,364 or 45% of the total trade area. Within this trade area the News-Miner circulated a total of 14,760 papers. Of this total 11,698 or 79% were distributed within the defined city region (See Table 3.).

The rural population lying outside this defined city region has a total population of 37,961. By separating this remaining population into rural settlements and rural homesteads, one finds that 26,074 or 61% of the inhabitants are found in rural settlements.

By grouping the 73 settlements in increments of 100 population, the most frequent group is that of the less than 100. This group contains 24 settlements or 33% of the region's total places. These settlements, as a group contain 5.7% of the region's rural settlement population. The second most prevalent size group is the 100-199. This group numbers 23 in total and has 32% of the region's settlements. It contains 3,179 inhabitants or 12.2% of the region's total settlement population. The remaining groups from 200-999 total 21 in number or 28% of the settlements, and combined, total 7,163 inhabitants or 27% of the regional settlement population. Thus by totalling all groups from less than 100 to 999, it is found that the aggregate contains 93% of the settlements in the trade region and has a total population of 11,817 or 45% of the trade area's settlement population.

According to the ABC's trade area statistics, (See Table 3.) there are only six settlements within the less than 100 to 999 grouping that receive more than 25 copies per edition. In total these settlements account for 27% of the regional circulation. The largest receiver is Delta Junction which receives 522 papers or 23% of the regional total.

FIGURE 11

RETAIL TRADE AREA OF FAIRBANKS AS DELINEATED BY NEWSPAPER CIRCULATION

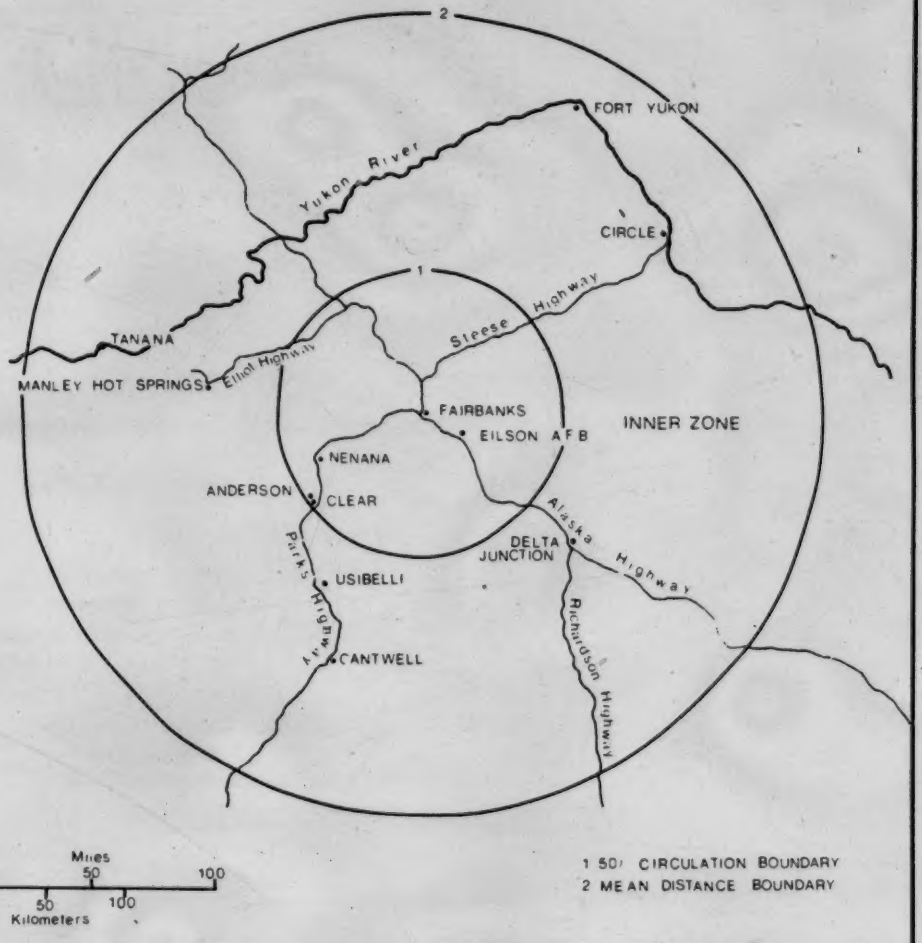

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Table 3

Newspaper Circulation Data for the Fairbanks Daily News Miner 1974-75

Name of Receiving Settlement	Number of Newspapers Circulated to Rural Settlements Per Issue	Population of Receiving Settlement	Ratio Index of Receiving Settlement*	Distance Between Receiving Center and Fairbanks (Miles)
Eilson A.F.B.	992	6,149	1.4	20
Delta Junction	522	703	6.2	91
Fort Greely	231	1,820	7.9	105
Anchorage	210	42,582		270
Barrow	145	2,104	145	515
Nenana	86	362	4.2	40
Clear**	70			60
Anderson	61	362	5.9	58
Tok	55	214	3.9	175
Juneau	50	6,050		645
Usibelli	38	167	4.4	76
Valdez	38	1,005		345
Kotzebue	31	1,696		440
Glenallen	30	363		200
Nome***	25	2,488		521
Galena	10	302	30.2	266
Tanana	10	120	12.0	130
Fort Yukon	5	448		150

Out-of-State Circulation

All other states 323

*Ratios listed are only those for cities within the newspaper circulation trade area. Ratios higher than 50 readers per paper have been excluded.

**Population combined with Anderson.

***Interview

Source: ABC Audit Report--Newspapers, 1975.

Delta Junction is also the second largest receiver of the total rural circulation.

The remaining settlement groups of 1,000 population and above total five in number. These groups combined total 14,257 or 55% of the region's settlement population and represent 7% of the total number of places. The largest settlement, actually a military base, with 6,049 inhabitants, is the largest receiver of rural and regional circulations. It receives 922 papers per edition or 44% of the regional and 32% of the total rural circulation. The 1,000 and 2,000 groups each have two settlements within them and account for 31% of the regional settlement population, and account for 14% of the regional circulation or 14% of the total rural circulation total.

Inter-regional and inter-state circulation of the News-Miner totals 677 papers or 23% of its full circulation. Inter-regional circulation accounts for 353 papers or 12% of the total circulation , but for 52% of the combined inter-regional and inter-state total. Anchorage is the largest receiver of papers on an inter-regional basis with 210 papers received or 59% of the circulation. This is followed by Juneau which receives 50 papers for 14% of the total. It is also interesting to note at this time that Nome receives 25 copies per edition from Fairbanks and also receives 64 copies from Anchorage. Thus on an interaction basis Nome should actually be tied more to the Anchorage trade region than with that of Fairbanks. Inter-state data was not broken down, thus all that can be said is that the News-Miner sends 323 copies per edition to the 'lower 48' states. This total accounts for 11% of the News-Miner's total circulation.

The index ratio showing paper readership per inhabitant on an individual village basis within the region (excluding Nome) is 19.58 persons per paper. There are two anomalies which cause this number to be so high. These are the cities of Kotzebue and Fort Yukon. If these two cities were excluded, a mean readership would be a healthy 9.06. In commenting on this data, the author is inclined to believe that the number of papers allotted to Fort Yukon is too small and that Kotzebue is, at least in the case of the News-Miner, a marginal trade partner. On the other hand, most other settlements in the trade region show a good readership ratio, the strongest of which are Eilson Air Force Base, and Nenana, with a 1.4 and 4.2 ratio respectively.

The inner zone's two boundaries were found to be at distances of 264 kilometers (164 miles) and 93 kilometers (58 miles) for the mean distance and 50% circulation

boundaries respectively. The mean distance boundary, like that of Anchorage, is quite extensive. This is the result of Barrow and Kotzebue being so remote from Fairbanks. If these two cities were excluded from the calculations, the mean distance would be decreased to 170.5 kilometers (106 miles). These boundaries are shown in Figure 11 and Figure 17.

Reilly's breaking-point between Anchorage and Fairbanks already has been mentioned, thus needs no further explanation here except to state again that the break-point is located right at the outer circulation boundary.

The Bethel Trade Area

The newspaper which serves Bethel and its surrounding area in western Alaska is called the Tundra Drums. Physiographically, the Bethel area is composed mainly of a low lying marshy deltaic region bounded to the north by the Nulato Hills and to the south by the Kuskokwim Mountains. Within this low-lying area, there are many small lakes, and two major river systems which terminate at tidewater into the Bering Sea. These are the Kuskokwim and Yukon Rivers.

The city of Bethel (population 2,416) is the major center within the region. It functions mainly as a regional transportation and service center for a predominantly native population. Services found within the city include general stores, restaurants, a movie theater, a mental health clinic, and a general hospital. Educational facilities include elementary, secondary, and post-secondary schools. There is also a law court in the city along with local and state trooper headquarters.

The settlement pattern in the Bethel region is almost entirely rural. Villages are scattered throughout the low-lying delta areas of the Kuskokwim and Yukon Rivers, and along the Bering Sea coastline. Transportation to and from these areas is by boat and airplane. Intra and inter-regional roads are non-existent in the area, although minor road systems do exist within some settlements. The area of newspaper circulation encompasses in total the census divisions of Bethel and Wade Hapmton, and also parts of the Kuskokwim and Nome divisions (See Figure 12.). Taking the whole of these census divisions (excluding Nome), a total population of 13,802 was reported by the 1970 census count. The Nome census division was excluded from the Bethel trade region

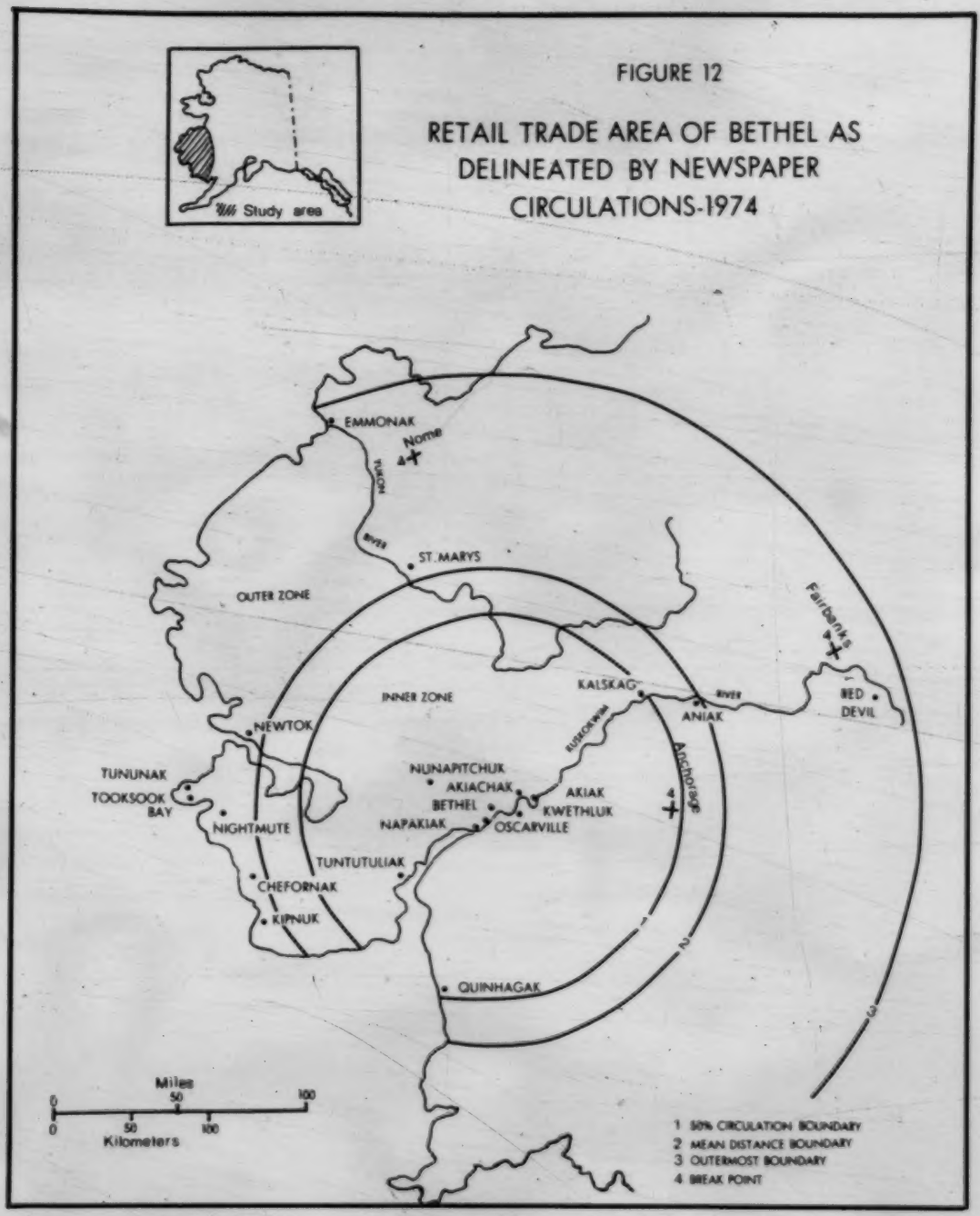

FIGURE 12

RETAIL TRADE AREA OF BETHEL AS DELINEATED BY NEWSPAPER CIRCULATIONS-1974

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count for two reasons. The first reason was that only a small part of its southern boundary is included in the Bethel trade region. Secondly, it did not contain any settlements. Of this total census population, the newspaper's outer trade boundary contained approximately 12,830 persons, or 93% of the total population base included within the outer boundary of circulation, including the city of Bethel,. A population base of 7,153 or 56% of the people was reached by the Drums' circulation (See Table 4.).

Table 4 lists the villages served by the newspaper, the number of papers each village received monthly, the 1970 population of each village, the ratio of copies per issue to the population of each village, and the distance between each village and Bethel.

The city of Bethel alone receives 86% of the total circulation per issue. This is the second highest intercity circulation of newspapers in this study. The highest is Juneau's Southeast Alaska Empire. As for rural circulations within the Bethel trade area, Table 4 shows that settlements were receiving 40 of 20 copies per issue. In total 15 places were listed as receiving 40 copies and 6 as receiving 20 copies per issue. Because Anchorage, Alaska, is external to the region it is omitted from the calculations, but considered as the external regional center interacting with Bethel and its regional territory.

As for the percentages of papers received per issue by each settlement, the places receiving 40 copies account for approximately 6% and those receiving 20 copies approximately 3% of the rural circulation per issue. Settlement populations within the trade area range from 41 to 439 people, with a mean average of 237. Distances between these settlements and Bethel range from 8 kilometers (5 miles) to 267 kilometers (166 miles) with a mean distance of 121 kilometers (75 miles).

By observing the index of papers read by inhabitants of each village, the index ranges from a low of 2.1 to a high of 20.4 for the villages of Oscarville and Kwethluk respectively. The index has a mean of 7.2 persons per paper.

From the data base presented in Table 4, actual trade boundaries were delineated for the Bethel region. Two different regional boundaries are shown, each on a different scale. Figure 12 shows the trade area on a local regional scale and Figure 17 displays the area on a statewide basis in reference to other trade boundaries.

Table 4

Newspaper Circulation Data for the Tundra Drums of Bethel 1974-75

Name of Receiving Settlement	Number of Newspapers Circulated to Rural Settlements Per Issue	Population of Receiving Settlement	Ratio Index of Receiving Settlement Persons/paper*	Distance Between Receiving Center and Bethel (Miles)
Akiachuk	40	312	7.8	16
Akiak	40	171	4.3	20
Anchorage	40			400
Chefornak	40	146	3.7	96
Emmonak	40	439	10.9	166
Kalskag	40	122	3.1	75
Kipnuk	40	325	9.1	97
Marshall	40	175	4.4	74
Napakiak	40	270	6.8	10
Newtok	40	114	2.9	97
Nunapitchuk	40	390	9.8	25
Quinhagak	40	340	8.5	73
St. Mary"s	40	384	9.6	100
Tooksook Bay	40	257	6.4	116
Tununak	40	272	6.8	119
Aniak	20	205	10.3	92
Kwethluk	20	408	20.4	12
Nightmute	20	127	6.4	103
Oscarville	20	41	2.1	5
Red Devil	20	81	4.1	161
Tuwtutuliak	20	158	7.9	45

*Ratios listed are only those for cities within the newspaper circulation trade area

Source: Newspaper Survey Questionnaire

The delineation of trade zones for the Bethel area is as follows. An outer boundary was found at a distance of 273.5 kilometers (170 miles) from the city. This is the boundary which covers the whole area of regional market penetration. The inner zone's mean distance boundary was established to be 121 kilometers (75 miles) and the 50% circulation boundary was at 148 kilometers (92 miles).

As for the theoretical boundaries determined by the formula derived from Reilly's law of retail gravity, breaking-points are shown on both the regional and state maps (See Figure 12 and Figure 17 respectively.). These theoretical determinations are shown between the centers of Anchorage-Bethel, Fairbanks-Bethel, and Nome-Bethel. The breaking-point of each pair is 545.5 kilometers (339 miles), 645 kilometers (401 miles), and 232 kilometers (144 miles) respectively.

By examining these breaking-points on an inter-regional scale, it is evident that there is a close relationship between the theoretical breaking-points and Bethel's delineated trade boundaries, with no one breaking-point being more than 56 kilometers (35 miles) from a corresponding regional boundary of the Bethel region.

First of all, Anchorage shows the deepest penetration into the trade area, thus it is theoretically the dominant city interacting within the Bethel area. Its breaking-point with Bethel is located just 8 kilometers (5 miles) from the mean zone's innermost boundary (See Figure 17.). On the other hand both Fairbanks and Nome have weaker penetration according to Reilly's law and thus theoretically should have a weaker market interaction within the area.

To determine the validity of Reilly's law and the breaking-point formula derived from it, an inspection of the newspaper circulation data for the four cities supports the combination of Reilly's law and the breaking-point formula to be an accurate, workable and valid theory for the Bethel region. Anchorage does in fact have the greater amount of newspaper circulation in the Bethel region, and Bethel in turn has the greatest interaction with Anchorage, with 51 and 40 copies respectively sent to each other per edition. Fairbanks on the other hand, lists zero copies sent to Bethel, and Bethel zero copies to Fairbanks. However, this does not mean Fairbanks does not send copies to the Bethel region because less than 25 copies per edition are not listed by the ABC (Audit Bureau of Circulation, 1975) report. Nome-Bethel interaction is also weak with Nome sending only

two copies to Bethel and Bethel likewise two copies to Nome.

For Fairbanks and Nome it can be said that Bethel's outer zone is associated with their breaking-points which depicts a weakness of market penetration and interaction. Anchorage, on the other hand, can be said to be associated with the inner zone which has a stronger market penetration and interaction.

Another peculiarity which has revealed itself from the regional analysis of the Bethel area, and also from the statewide map of delineated newspaper trade regions, is that there is a market void present. This anomaly is located in the Kuskokwim census region. It covers the whole census division from the outermost boundary of the Bethel region (See Figure 12 and Figure 17.). It is a market area centered on the city of McGrath which neither Fairbanks, Anchorage, or Bethel claim as a part of their trade regions.

The Nome Nugget Trade Area

The Nome trade region is situated in the northwestern section of the state. The region is mainly mountainous and hilly in nature. The only areas with extensive low-lying terrain are located adjacent to the region's coastal area and around the Kotzebue Sound region in the area's northeast sector.

The City of Nome (population 2,488) in which the Nome Nugget is published is located on Norton Sound, with the Kigluiak Mountains to its north. As with the Bethel area, air transportation is the main mode of transport serving the region. There are however, four secondary roads radiating from Nome, but their usage is for the most part limited to summer time travel. As for the areal extent of these roads, no one road is more than 145 kilometers (90 miles) in length. In total these roads pass through 15 settlements, some of which are non-permanent and only one of which receives the Nome Nugget.

In relation to other cities of the same approximate size in Alaska, Nome is quite heavily endowed with public and private service establishments. There are three factors which contribute to this condition. These are location, government services, and tourism. Because Nome is an isolated regional center of Northwest Alaska, and because the major government and service centers of Anchorage, Fairbanks, and Juneau are so distant from it, government offices, both state and federal, have located within the city. Government

services include a Federal Aviation Administration office, a National Guard Armory, a state trooper headquarters, and a court house. Also situated in the city is the main office of the Bering Straits Native Regional Corporation. Other services include a general hospital, a health care center, a long term care center, and various state and federal agencies which are assisting in the advancement of socio-economic development of the region. Schooling is available through the 12th grade, and the city has a post office.

Nome is also a tourist center. This has helped in the expansion of private services within the city, especially in the creation of hotel and gift shop facilities, laundromats, food and clothing stores, bars and liquor outlets.

By examining the Nome Nugget's circulation data, three observations become evident that were not common with the other papers. The first feature, to be noted in Table 5, is that only 400 papers or 41% of the total circulation is in-town distribution. This figure is quite low considering the 70 and 80% figures for the other papers. It is also evident from Table 5 that a large number of papers are being sent out-of-state, this total represents 300 papers or 31% of the total newspaper production. This leaves only 282 papers or 28% of the circulation total to be distributed within the state, and of this total, 135 papers are inter-regional circulations to the cities of Anchorage, Fairbanks, Juneau, and Kotzebue. This leaves only 147 papers or 25% of the total rural circulation to be distributed within the Nome trade region.

Finally, it is noted that the number of papers sent to the regional villages was very low, in fact, they were the lowest figures encountered in this study. The ratio index of readers per paper helps to bear out this point. These indices run as high as 231 to a low of 10.1, which in itself is a high number. Therefore, in the strictest sense, it could be said that the Nome Nugget's trade region is very weak, and for all intents and purposes lacks a cash economy to support it. The region thus should be considered at this point of the study as underdeveloped.

The presumption that Nome is lagging is further supported by a publication of the Institute of Social, Economic, and Government Research, at the University of Alaska, Fairbanks, (March, 1975). In this article, which pertains to gross product by region and further divided by industry, the Northwest Region in which Nome was included was the second lowest region in the state in terms of gross product in current dollars during

Table 5

Newspaper Circulation Data for the Nome Nugget 1974-75

Name of Receiving Settlement	Number of Newspapers Circulated to Rural Settlements Per Issue	Population of Receiving Settlement	Ratio Index of Receiving Settlement Persons/paper*	Distance Between Receiving Center and Fairbanks (Miles)
Anchorage	75	42,582		540
Fairbanks	40	14,771		521
Juneau	30	6,050		1,113
Kotzebue	20	1,696		185
Koyuk	12	122	10.1	129
Savoonga	12	364	30.3	165
Gambell	12	372	31.0	197
Wales	12	131	10.9	110
Elim	12	174	14.5	95
Shishmaref	8	267	33.4	123
Unalakleet	5	434	36.8	147
Barrow	4	2,104		523
Ketchikan	4			1,342
Golovin	4	117		72
Brevig Mission	4	123	30.7	67
Buckland	3	104	34.6	183
Kiana	3	278	92.6	223
Dillingham	2	914		440
McGrath	2	279		320
Teller	2	220	110	58
Bethel	2	2,416		283
White Mountain	2	87	43.5	62
Deering	2	85	42.5	134
Kenai	2	3,533		528
Stebbins	1	231	231.0	118
St. Michael	1	207	207.0	125
Shaktoolik	1	151	151.0	130

*Ratios listed are only for cities within the newspaper circulation trade area. Ratios higher than 50 readers per paper have been excluded.

Out-of-state circulations amount to 300 issues per circulation. The states represented are: California, Arizona, Michigan, Iowa, Pennsylvania, Massechusetts, New York, New Jersey, Oregon, Ohio, Illinois, Kansas, Missouri, Texas, New Mexico, North Carolina, Tennessee, Minnesota, Maryland, Virginia, North Dakota, and Hawaii.

Source: Newspaper Survey Questionnaire

1973. It had a total gross product of only 79.2 million dollars for the year. This figure is approximately two times smaller than the third lowest region in the state. This region is the Southwest, of which Bethel is a part. Compared with Anchorage, which has the highest gross product, this is 15 times smaller.

It should also be pointed out that this Northwest region (Figure 13) also inludes a part of the Arctic Slope and includes the City of Barrow. These two areas include important oil and gas revenues plus related industrial revenues which are not included in the Nome trade area's boundary, thus the gross product for the Nome region would be smaller yet. The report also reveals that the Northwest region lacks totally in income derived from wholesale and retail trade and in manufacturing. Services and finance, insurance, and real estate are also low in gross product. These latter two industries accounted for 18.2 million dollars or 23% of the region's total gross product.

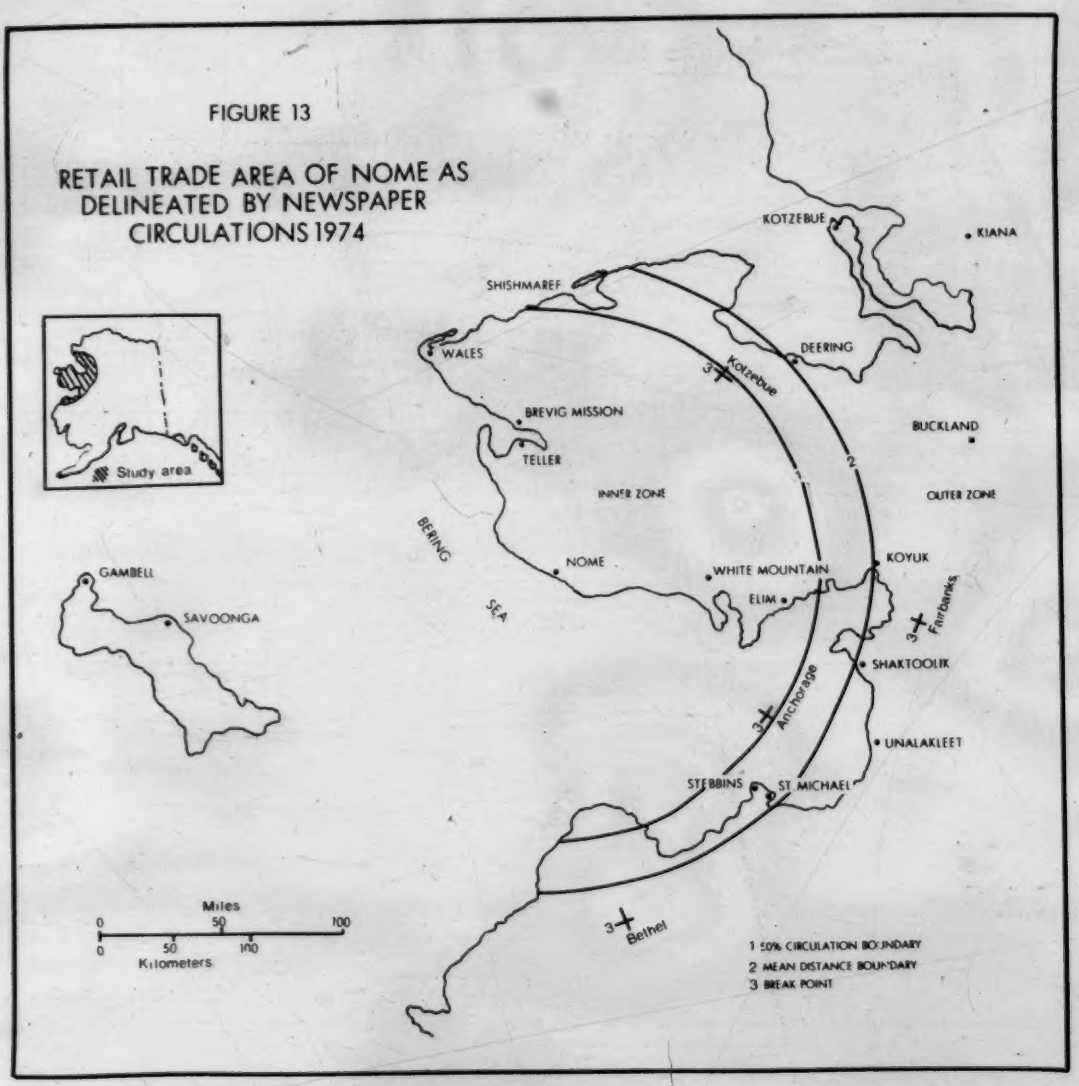
Included within the outermost trade boundary of the Nome Nugget, shown in Figure 13, was a total of 18 villages. These villages, excluding Nome, had a total population count of 3,551. The populations of the villages ranged from 84 to 434 persons. By grouping these villages according to population increments of 100, it was found that the 200-299 group contained the largest population base. This group of five villages had a population count of 1,203 or 34% of the trade region's population. The 100-199 group was the second most populous. This group had seven villages within it and had a population of 922 or 26% of the population. These two groups thus comprise 60% of the trade area's population.

In areal extent the trade area reaches 370 kilometers (230 miles) from Nome. It includes the whole of the Nome census region, drawing readership from the villages of Deering, Buckland, and Kiana. By extending this boundary into the Bethel region it is seen that there is an overlapping relationship between the mean and 50% circulation zone of the Tundra Drums and that of the Nugget's outer zone. This overlapping can be explained by the great distances over which the villages receive the Nugget. This in turn is a possible indicator of Nome's tendency to become a regional center of the Northwest region. This association between trade zones is shown on the map in Figure 17.

It may be noted that Kotzebue also has a small local paper and if it were included in this study, it would somewhat diminish this extensiveness through the deletion of

FIGURE 13

RETAIL TRADE AREA OF NOME AS DELINEATED BY NEWSPAPER CIRCULATIONS 1974



Kotzebue, and the probable deletion of Kiana and Buckland. If this were done the Nome Nugget's outer boundary (excluding the distant anomalies of Gambell and Savoonga) would be reduced to 241 kilometers (150 miles) and would thus be slightly more than its outer mean boundary. This reduction is shown by a dashed line in Figure 17. Also shown in this figure by a dashed line is the probable outer zone boundary of the Kotzebue paper. Its distance would be 265.5 kilometers (165 miles) from the city center.

The inner trade zone, according to the 50% circulation coverage figures, was found to be at a distance of 177 kilometers (110 miles) from Nome. The second indicator of mean village distance for the region was calculated at approximately 209 kilometers (130 miles). These boundaries are shown in Figure 13 and Figure 17.

For the Nome region, four breaking-point distances were determined, all of which correspond very closely with the actual defined boundaries of the mean trade zone for Nome. The two most penetrating cities are Anchorage and Kotzebue, both of which have break-points lying just inside the inner mean trade zone boundary. The Bethel breaking-point lies just outside the zone's outer mean boundary and Fairbanks, the weaker of the four zones lies approximately 26 kilometers (16 miles) from the same boundary.

Southeast Alaska Trade Areas

The Southeast region of Alaska has three principal daily papers in publication. They are published in the cities of Juneau, Ketchikan, and Sitka. There are also two weekly papers published, one in Petersburg and the other in Wrangell. Of these five papers the Ketchikan Daily News, of Ketchikan and the Southeast Alaska Empire of Juneau will be analyzed[17]. There were three reasons for evaluating these two cities. First, they are the two largest cities in the region. Secondly because they are 378 kilometers (235 miles) distant from one another, they provide for a better north-south areal

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[17] The exclusion of Sitka in this analysis was based on the folllowing factors. The City of Sitka, according to the 1970 population statistics is approximately one-half the size of the cities of Ketchikan and Juneau. Secondly, because Sitka is located on the windward coast of an outer island it has a relatively greater degree of isolation as compared to Ketchikan and Juneau. The third reason for exclusion relates to a comment sent back on the survey form which stated that the only outside papers which have several copies sold in the city are the Seattle P.I. and the Anchorage Times.

representation of the region. Thirdly, the Ketchikan Daily News and the Southeast Alaska Empire are the two largest circulating papers in Southeastern Alaska.

Physiographically, Southeastern Alaska, is a mountainous region. Its coastline is indented by numerous fjords, bays and coves. The islands which lie off the mainland are closely juxtaposed with many channels and straits between them, thereby making possible sheltered waters for a coastal marine transportation system with many similarities to that of Norway.

The northwest-southeast areal extent of Southeastern Alaska is about 804.5 kilometers (500 miles), but 99% of the population lives between Ketchikan and Skagway, a distance of 558 kilometers (370 miles). The isolated settlement of Yakutat, in the extreme northern part of the region, is the exception. The region's average width from the mainland coast to the windward coast of the outermost islands can be said to be approximately 160.9 kilometers (100 miles).

Four modes of transportation are represented within the region. They are marine, air, road, and railroad, with the former two being the most widely used. The railroad is privately owned, is international in operations, and uses narrow gauge trackage. Its main function is a carrier of lead-zinc concentrates and asbestos fibers from Whitehorse to the duty-free port of Skagway. It does however offer passenger and freight service on a limited basis between the two cities. The road system provides for two outlets from the region, one from Haines, and the other via Skagway. Both roads connect with the Alaska Highway in the Yukon Territory of Canada. All other roads in the region are local in character and serve only as a linkage between a settlement and its immediate surroundings. The marine ferry system is operated and subsidized by the state as a part of the road system. It serves the major cities of the region on a scheduled basis. The system is a major carrier of freight and people to, from, and within the region. Air transportation is also an important means of freight movement and passenger travel in the Southeast. It is especially important for the smaller isolated villages which are not served by the marine system.

The 1970 census listed Southeast Alaska as having 47 settlements with a combined population of 42,565 within its nine census regions. By grouping the divisions so that 50% of the total population is found north and south of a particular line, one finds

that the southern division line of the Angoon census division and the eastern and southern divisions of the Sitka census region approximates these figures. The northern half, which contains Juneau and its boundaries, has 20 settlements or 43% of Southeastern Alaska's total places. The total number of residents found in the northern part is 23,829. The southern part has 27 settlements or 57% of the region's total and has a population of 18,736.

By first examining the circulation data in Tables 6 and 7 for the Southeast Alaska Empire of Juneau and the Ketchikan Daily Times, respectively, distinctive characteristics are found.

Three main points can be noted in the analysis of the Empire's circulation data [11]. The most striking is the number of papers sent to the two largest cities of Anchorage and Fairbanks. Each of these centers was receiving approximately 19% of the rural circulation. If an in-depth analysis were to be made of specific functions of newspapers, this high number no doubt would be attributed to Juneau's position as the state capital, and therefore the paper is a prime medium for political and administrative flows to these two cities.

Also noted is the small number of newspapers being sent to Petersburg. This number is only 1.9% of the rural circulation or 10 papers per edition, and is an indication of the Empire's farthest southward penetration. Last to be noted is that the readership of papers on a per capita basis in each village was quite high with the mean rural readership being 59.12 persons per paper. This is an indicator of two characteristics of the paper. First it is an in-town paper and secondly, it is a specialized inter-regional Alaskan paper serving the two largest political and service centers of the state. The former point can be substantiated by looking at Table 6 which shows the Empire's in-town circulation.

Table 7, which shows the Times' circulation data, is also interesting. Like the other papers in this study (with the exception of Nome), it is first and foremost an in-town paper, but here the similarity stops. Three characteristics of this paper can be noted. First, is the fact that it serves numerous small settlements in its territory. Secondly, the readership of these settlements is more concentrated, that is, more inhabitants per village

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[11] The Empire did not send much information back as to all villages which it serves, but the information that was included is ample for boundary delineation purposes and does shed light on the paper's specific importance as an inter-regional paper.

Table 6

Newspaper Circulation Data for the Southeast Alaska Empire of Juneau 1974-75

Name of Receiving Settlement	Number of Newspapers Circulated to Rural Settlements Per Issue	Population of Receiving Settlement	Ratio Index of Receiving Settlement Persons/paper*	Distance Between Receiving Center and Juneau (Miles)
Anchorage	100	48,081		573
Fairbanks	100	14,771		626
Angoon	25	400	16.0	58
Haines	25	463	18.5	75
Hoonah	25	748	29.9	40
Skagway	25	675	27.0	87
Petersburg	10	2,042	204.2	115

*Ratios listed are only those for cities within the newspaper circulation trade area

Source: Newspaper Survey Questionnaire

Table 7

Newspaper Circulation Data for the Ketchikan Daily News 1974-75

Name of Receiving Settlement	Number of Newspapers Circulated to Rural Settlements Per Issue	Population of Receiving Settlement	Ratio Index of Receiving Settlement Persons/paper*	Distance Between Receiving Center and Ketchikan (Miles)
Metlakatla	150	1,050	7.0	18
Wrangell	97	2,029	20.9	83
Petersburg	92	2,042	22.2	116
Juneau	87	7,293		235
Hydaburg	62	214	3.5	48
Anchorage	62	48,081		802
Craig	56	272	4.9	60
Thorne Bay	56	443	7.9	45
Sitka	33	3,370		186
Klawock	27	213	7.9	58
Annette	22	195	8.9	20
Kake	20	448	22.4	145
Fairbanks	14	14,771		880
Valdez	4	1,005		668

*Ratios listed are only those for cities within the newspaper circulation trade area. Ratios higher than 50 readers per paper have been excluded.

Out-of-State Circulations

Washington 86
California 25
Oregon 20
Miscellenaeous States 55

Source: Newspaper Survey Questionnaire

read the paper. The mean readership is 11.7 persons per paper. It therefore can be said that the Times has a greater attractiveness and trade influence in its trade zone than does the Empire of Juneau.

Finally, the Times, like the Nome paper, is an important inter-state newspaper. In total it sends 19.3 % of its rural circulation to the states. Of this total, 13.6% is sent to Washington, California, and Oregon. Washington receives the most with 8.9% of the rural total. This latter point is most interesting since Anchorage only receives 6.4% of the rural total, thus the Ketchikan area appears to have stronger trading ties with the west coast than it does with metropolitan Alaska.

The delineation of the actual boundaries and the theoretical breaking-point for the Southeast Alaska Empire and the Ketchikan Daily Times, will be combined in this analysis since they are represented in a single region, and show a zone of trade area overlap (See Figure 14 and Figure 17.).

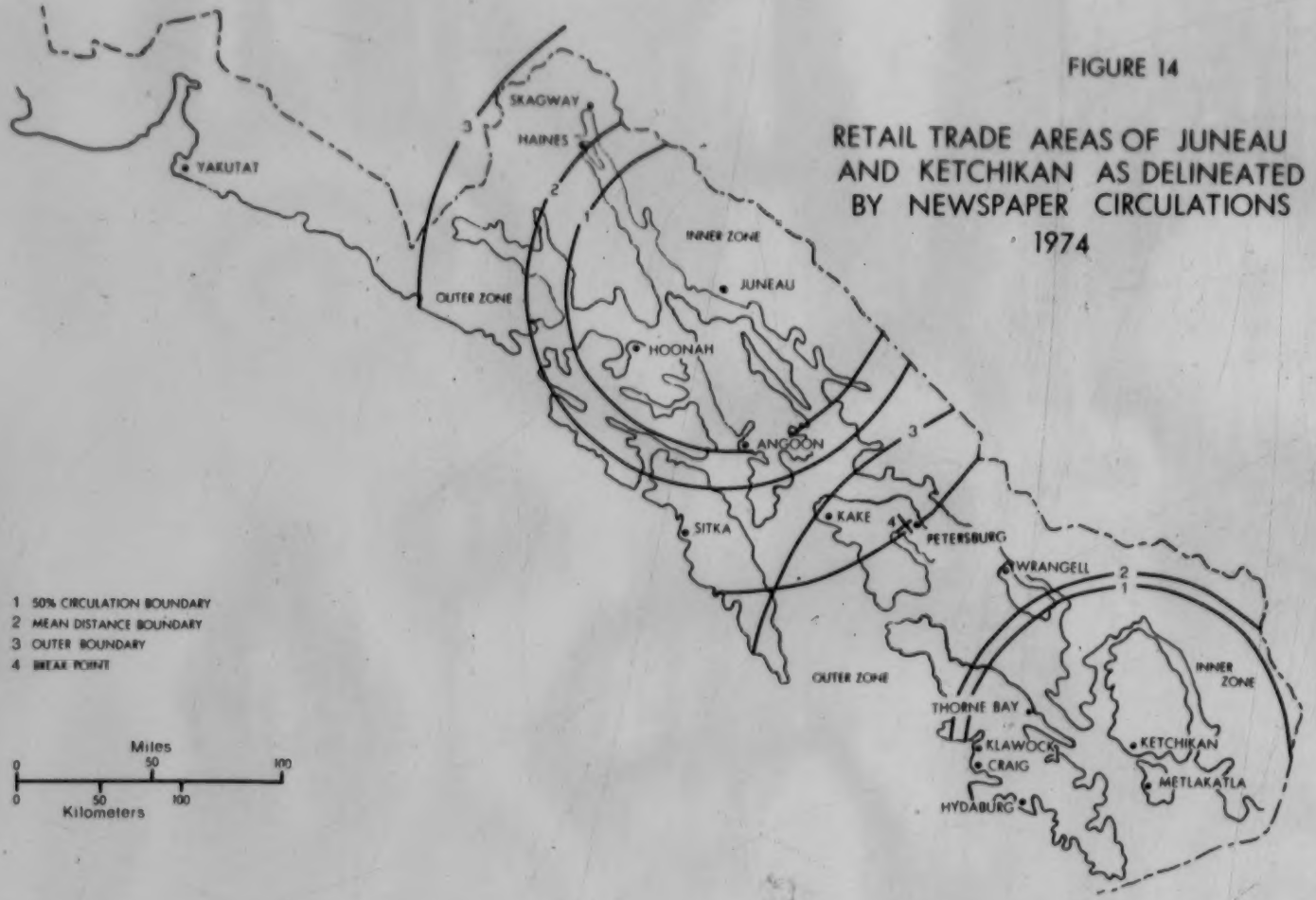
By first looking at the outermost boundaries of circulation for the two papers one notes a zone of overlap. The outer zone of the Empire extends its boundary of influence to the city of Petersburg, and the Times extends its boundary to the city of Kake. In areal extent, Juneau's outer boundary of newspaper circulation is 187 kilometers (116 miles) from its city center and Ketchikan's outer reach is 233 kilometers (145 miles). The notable characteristic of this zone is that Ketchikan is the dominant trading city in the zone since it carries a greater percentage of newspaper circulation. Secondly, the zone is not that great in areal extent, being only 48 kilometers (30 miles) at its maximum extent.

Also noted at this time is the location of Reilly's break-point between the two cities. This distance is 183 kilometers (114 miles) from Juneau and is located 1.6 kilometers (1 mile) northwest of Petersburg. This point approximates Juneau's outer circulation boundary so closely that they can be said to be one in the same. This breaking-point helps to further substantiate that Petersburg is dominated by the Times and in turn the actual delineation of the boundaries helps to strengthen Reilly's formula.

The inner trade zones of the two papers have similar outer boundaries. The Southeast Alaska Empire 's inner zone extends outward for 121 kilometers (75 miles) and the Times' for 106 kilometers (66 miles). This is only a 14.5 kilometer (9 mile) difference between the two zones. The distinguishable feature between their respective zones is

FIGURE 14

RETAIL TRADE AREAS OF JUNEAU AND KETCHIKAN AS DELINEATED BY NEWSPAPER CIRCULATIONS 1974



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that the Times has less distance between its two inner zone boundaries, a fact which can be attributed to a greater concentration of settlement population in relation to the city.

Looking at the southeast region as a whole with respect to news coverage, one anomaly appears to stand out. This is the village of Yakutat in the extreme northern end of the region, which was found not to be receiving papers from its 'southeastern' counterparts.

E. Observations and Summary

From the analysis of newspapers in this chapter, several distinct characteristics have been recognized. The first is that there are two large and distinct newspaper retail trade areas in the state. These are the Anchorage and Fairbanks regions. Through the analysis of these regions, several observations were made. The first and most impressive phenomenon is the areal extent of their combined trade areas. This area covers the whole state except for two areas. The first area, that of Southeastern Alaska, is very marginal to these two papers and if it were not for Juneau, the area could be deleted altogether. As it stands, Juneau is the only noteworthy city in Southeastern Alaska which has interaction with Anchorage and Fairbanks. With respect to southward flows of information, Anchorage is the dominant city. This is not the situation, however, for northward flows from Juneau. Here both Anchorage and Fairbanks receive equal circulations. One can assume this equal northward flow is in part due to Juneau's position as the state capital, thus news developing within the city carries a greater importance on a statewide basis, and therefore flows north to the two major urbanized areas of the state. It can also be assumed that since both cities receive the same number of papers, and because Fairbanks is by far the smaller of the two receiving cities, that Fairbanks has the greater interaction.

A second important observation of an existing void between retail trade regions also was uncovered in the analysis of the Anchorage and Fairbanks trade regions. It was further confirmed from the analysis of the Bethel trade regions. This void is located in the Kuskokwim Census Division, and is not claimed by any one city as being part of its

trade region. Geographically speaking, it is a regional isolate encircled by the Kuskokwim Mountains and the Alaskan Range with no pronounced valleys or passes leading in the direction of a major city.

Also noted in the analysis of the Anchorage-Fairbanks retail regions, is that Fairbanks claims Nome to be in its trade area. This was found not to be the case in point. Nome, first of all, has a greater two-way interaction with Anchorage and secondly, by applying the breaking-point formula between the two cities and Nome, it was found that Anchorage had the deepest penetration into the Nome trade region.

Another observation within these trade areas is the small yet important number of circulations which are apparently received by the small isolated villages and the rural homesteads in their trade areas. These are the places which receive less than 25 copies per issue. In total only 2% of their combined circulations reach these people. It must be recognized that some of the rural villages may be secondary distributors of the papers for these inhabitants, but in sheer numbers of people involved (58,508), it would appear that the majority of these people are without news via the press.

With respect to the extent of the mean distance boundary of the inner trade zone, the Anchorage, Fairbanks, and Nome regions involve extensive distances. This situation is a product of their large non-competitive trade areas, within which there exist anomalies. These are specific villages that are distant from the main group or groupings of settlements within the trade region. In the Anchorage region, Kodiak, King Salmon, and Dillingham are the isolates. In the Fairbanks region, they are Barrow and Kotzebue, and in Nome the settlements are Kiana, Buckland, Gambell, and Savoonga, the latter two of which are on St. Lawrence Island.

As for inter-state circulations, the Nome Nugget and the Ketchikan Daily Times are of particular interest. These two cities are similar in that they both have a large out-of-state circulation. Nome is by far the more important, with 31% of its total circulation being distributed out of state. Although Ketchikan's total state-side circulation is only 5% of its total circulation, it is a meaningful percentage, particularly when compared with Anchorage. In comparing out-of-state circulation on a rural circulation basis, Ketchikan distributes 19% of its total to other states while Anchorage sends only 1.6%. In both cases however, Washington is the largest receiver.

As for reasons why Nome and Ketchikan have large out-of-state circulations various factors could be involved. In the case of Nome, the large number of out-of-state circulations could be attributed to the city's historic importance which captivates and sustains the tourists' interest on a prolonged basis through yearly subscriptions to the Nugget [19]. Another factor to be considered could be its transient population, in which those people who are there for short periods of time (i.e. federal employees) want to keep up with current events of the city once they have moved south. As for Ketchikan, the most probable causes of stronger ties with the 'lower 48' states, and in particular with Washington, could be due to its isolation from the main population and distribution centers of Alaska and corresponding greater proximity to Seattle. It could also be due to the fact that it is the first major port of entry to the state from the west coast.

By examining the inner trade zone of the six newspapers, two characteristics can be noted. The first is the inverted boundaries of the Bethel region. This is the only case in which the 50% circulation boundary is the zone's outer limit. This phenomenon is caused by the local distributive nature of the Tundra Drums' circulation and by its small numbers of rural circulation. With regards to the inner zone's invertedness, one can see that the settlements are tightly knit compared with the settlement patterns of other regions; this is reflected through the zone's mean distance boundary at 121 kilometers (75 miles). At the same time it is observable that no one settlement outside of Bethel has a dominant receivership of the paper, and that this receivership, on an individual settlement basis, is small and for the most part equitable in number. These factors therefore combine to produce a lenghtened 50% circulation line which extends beyond the mean distance boundary.

Another interesting observation about the inner zone on a state-wide basis was noted with respect to the 50% circulation boundaries. Here it was observed that the newspapers can be divided into two categories according to distances from the city centers. The first division includes the Anchorage, Fairbanks, and two Southeast trade

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[19] Gold was first discovered in the Nome area in 1897. The news of this discovery reached Seattle in 1898, but the 'rush' by prospectors to the area was dampened due to the corresponding Klondike 'rush'. This meant that fewer people favored the Nome area and opted instead for the Klondike. It was not until the end of the Klondike, that prospectors started migrating to Nome. In 1900 Nome's population (according to the United States census), was 12,360, but by 1903 prospectors by the thousands adventured to Nome seeking gold. The city's population quickly grew to around 40,000, but by 1910 the population had dwindled to 2,321.

regions. The second is that of Bethel and Nome.

The interesting aspects here are that the former regions all have built-up urban and urban fringe areas with interconnecting road systems, and that all these areas have 50% circulation boundaries which approximate a one-hour commuting time. The other category is in a more remote region of the state, and the cities do not have distinctive built-up urban and urban fringe areas. The road systems of the region are also not as complete. In this region the 50% circulation boundaries are twice the distance of the former category.

By comparing the outer boundaries of the Bethel and the adjusted Nome trade area, with the approximate Kotzebue trade area (The approximate Kotzebue trade area was arbitrarily drawn without data to substantiate it.), another similarity is apparent. This likeness involves the distance which each of these boundaries extends from its respective city. All three of these cities have the same approximate areal extent with a maximum variation of only 32 kilometers (20 miles) between the largest and smallest boundary.

It is interesting to note that the cities of Nome and Bethel have approximately the same population and have a hinterland dominance and penetration that are essentially the same irrespective of their location (coastal or riverine). The latter would theoretically have a strong areal trade dominance over its riverine hinterland due to navigable waterways as a means of penetration, while the former would favor coastal neighbors with less interior penetration.

Finally, by combining these three newspaper trade areas, a continuous series of sub-regions were defined. (See Figure 17.) They extend from Dillingham which is south of Bethel to Kivalina, north of Kotzebue. This system of sub-regions is circumscribed by the over-powering effects of the two large metropolitan papers of this state but nevertheless the sub-regions do exhibit their own important retail trade areas.

Finally it was shown that Reilly's breaking-point has worked well in this study. This is especially true in the cases of Anchorage and Fairbanks, and for Juneau and Ketchikan. In both of these cases, Reilly's breaking-point formula correctly located the distance at which the outer retail boundaries are located.

By applying the breaking-point formula to the Bethel and Nome trade regions, the associations were not as precise. The one similarity exhibited in these cases was that all breaking-points were located inside the outer boundary zones. Of these two cities, Bethel displayed the strongest association, with Nome and Fairbanks having the closest association. Both of these cities were found to be within 40 kilometers (25 miles) of the Drums' outer boundary. Anchorage, in contrast, had a breaking-point which was located inside the mean distance boundary of the inner zone. This deepened penetration is attributed to the great size difference of the two cities. Anchorage is more than 17 times larger than Bethel.

As for the Nome Nugget trade area the 50% circulation boundary of the inner zone is the best associative boundary. Both Anchorage and Kotzebue were located just inside this line. Fairbanks, on the other hand, has a breakinig point outside the mean distance boundary of the inner zone. As for the reasons why the breaking-point does not work as well in the Nome region, three causes can be suggested. First, is the extensiveness of the Nugget's outer boundary due to its drawing power as a regional center for the Northwest Region, and secondly to its exaggerated inner zone boundaries due to the region's sparse and distant population centers. Thirdly, penetration of the Anchorage breaking-point, although not as deep as in the case of Bethel, is due again to the population disparities between the two centers. At the same time the increased distance between Nome and Anchorage, as contrasted to that between Anchorage and Bethel, has modified the former by increasing the breaking-point distance between them.

IV. Air Route Networks as an Indicator of Regional Trade Boundaries

A second indicator of actual marketing trade interaction is the extent to which goods flow within a region or between them. For Alaska, in general, this interaction can best be measured in terms of transportation by air. The importance of air transportation as a means of delineating trade regions in Alaska is explained as follows. There is an inadequacy or absence of alternative means of regional and/or inter-regional transport. Secondly, air transport is able to overcome Alaska's four greatest barriers to trade interaction. These are terrain, time, cost, and distance. Here aviation has the ability to vector over physiographic barriers which totally inhibit other modes of travel or which otherwise greatly reduce their importance as a mode of interaction through time and/or cost constraints. Four characteristics of air transport thus help to strengthen its importance as an indicator of trade interaction and as an indicator of regional trade boundaries. This is due to the fact that air transportation is the fastest form of travel and because physiographic obstacles are in general not factors which inhibit its interaction. Therefore regional boundaries as delineated by this mode should portray the areal extent of interaction between a city and its hinterland. They should also show the strongest inter-regional economic ties between major regional cities. A further consideration about cost with respect to air transport within Alaska is that the importance of this mode of transportation is relatively uneffected by operating costs (eg. rising fuel and labor costs). Increases in these costs will not lessen its importance as a carrier of goods and services.

A. Previous Studies in the Field of Transportation Geography Which are Related to Spatial Interaction

One of the first North American geographers to complete a study of transportation flows through the technique of mapping commodity tonnages was Edward Ullman (1949). In his paper he stated that "transportation is a true measure of space relations and as such is basic to the study of geography... The relations and connections

between areas are reflected in the character of transport and the flow of traffic..." (Ullman, 1949, p. 242).

In his particular study the actual flow of tonnages from a particular state to other states were not examined or illustrated. Ullman rather showed total tonnages of particular commodity groupings sent from and terminating within a particular state. The study incorporated three indicators for analyzing the traffic flow network of the United States railroad system. These indicators included trackage for evaluating railroad densities, the central traffic control system to examine traffic flow variations, and the use of origin and terminating tonnages as indicators of variations in regional economic characteristics.

Taaffe, (1956) provided a geographic study of the air transport system in the United States. The study determined the degree of influence four factors had on the development of the air passenger network. The factors included were the size of urban populations, the effect of urban groupings, the effects of various urban functions and the competitive effects of railroad competition on the air system.

To determine the effects these factors had on the system, a statistical analysis was made for each factor and the findings were illustrated on a series of eight maps. The study included the analyzing of both standard metropolitan areas and cities as to their degree of importance as passenger generating areas. This was done through the use of a determined mean index of passengers per 1,000 population. Other comparisons included an analysis of air flows of traffic shadow and non-traffic shadow cities. The former was created by the clustering of cities within 192 kilometers (120 miles) of a major airport. The latter represented cities outside the 192 kilometer zone. Also included was a combined city function and non-traffic shadow city map. By combining these two criteria the population and traffic shadow factors were minimized, thereby allowing the analysis of city function as a generator of traffic on a per capita generation basis. The final analysis of this study included the mapping of non-traffic shadow cities in combination with overnight rail service from the major cities of New York and Chicago. This map illustrated the effect of overnight rail service on the passenger indices of the non-traffic shadow cities.

Taaffe (1962) published another article pertaining to air passenger traffic and its relationship with an urban hierarchy in the United States. In this study he compared the

actual air passenger traffic patterns for the years 1940, 1950, and 1955 with those derived from two variant forms of the gravity model. These forms were PP/D and PP/D^2, where P equals population and D equals distance.

From the analysis of actual traffic linkages two different types of air flows were revealed. The first was termed a dominance hierarchy. This type of flow resulted if City A was dominated by City B, if City B had more traffic to and from City A than any other city, and that City C in turn would dominate City B, if City D has more traffic to and from City A than any other city, and that City C in turn would dominate City B if the same situation held true. Through this linkage a hierarchy of dominance was formed. The second type of flow was described as being a reciprocal intra-regional dominance. This flow held true when two cities held more to and from traffic with one another than either one had with any other city.

Gravity models used in this study were of two forms. The first form was stated as PP/D traffic ratios. This model was used by Harvey (1951) for determining air traffic patterns in the United States. It simply stated that the air passenger traffic between two points is directly proportional to the product of the two populations and inversely to their distance. By comparing the results of this model with the actual dominance of air passenger flows on a series of maps the formula results were found to be invalid in that no heirarchy was evident. The major fault of the model was found to be in the weighting of the distance factor. Therefore the model was modified to the form PP/D^2 which gave a better generalization of the model's results by increasing the friction of distance. Also included with this modification in the second analysis is a 192 kilometer (120 mile) traffic shadow. This latter addition was used to decrease the high interaction figures of the largest cities. This traffic shadow excluded all traffic figures within 192 kilometers (120 miles) of major cities. The results of the second analysis were found to be more satisfactory and did produce evidence of a hierarchial pattern[20]

A study done by Taaffe (1959) examined to what extent the passenger traffic of the Chicago hinterland has changed. The study covered a seven-year period from 1949

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[20] Various forms of the gravity model are commonly used in the field of transportation, and have been used with different degrees of success. The more advanced inter-modal models are very complex and use as many as eight equations within their frameworks. Population and distance are commonly used variables, but other variables are also used in the model. These include income, time of travel, and price.

through 1955. The study used a series of maps along with a statistical analysis to examine, determine and describe the changing air linkages between Chicago and various interacting cities. Linkage transformations were associated with changes in passenger growth rates and this in turn revealed changes in the spatial organization of the passenger traffic network.

To analyze growth rates, four main factors were examined. These included length of haul, winter resorts, lowered coach fares, and traffic shadow cities. Other factors in the analysis included advances in aircraft technology as it relates to speed and distances flown and the number of air passengers which travel between specific city pairs and their relationship with the number of phone calls completed between the same. This relationship was expressed as a ratio of the number of air passengers per 100 phone calls between the specific city pairs.

Conzen (1975) examinied the American Midwest in an historic perspective as to the relationships between passenger transportation and the growth of urban fields of influence. The study covered the period from 1850 to 1908 and was divided into two parts. The first part mapped and examined the growth and decline of routes and frequencies of stage coach and railroad services offered during the study period. From these two modes two main characteristics were examined. These were the changing levels of frequencies and route densities. From the analysis of these two latter factors the existance of urban hierarchies and biases were examined and determined. The final outcome of the analysis was the mapping of urban spheres of influence at three specific dates within the time period.

The second section statistically examined through the use of factor analysis and multiple regression analyses the relationships between particular types of economic development in the region and their association with the areal changes in transportation accessibility.

B. Scheduled Air Route Networks

In this chapter scheduled air route networks are examined and analyzed with respect to their spatial flows and linkages[21]. The objective is to compare and determine relationships which exist between the pre-determined delineated newspaper boundaries of the 'Bethel-Nome' and 'Juneau-Ketchikan' trade areas with those of the presently scheduled airline route structures within these regions.

To evaluate the present airline route structures of these regions, three types of analysis were used. First were the determination of the dominant city interacting with the regional center (eg. Bethel) of each trade region, and the dominant city within each sub-system (excluding the regional center) which has the most interactions with all cities within the sub-system. (As for 'all cities', the regional center is counted as a city of interaction.) From the regional network analysis a hierarchy of air route sub-systems dominance in each region was determined by the total number of legs or stops made within a given system. Therefore, the most developed sub-system with respect to interaction within the regional air route system is the one having the greatest number of legs. The number of legs existing in each sub-system was determined by examining and totaling the number of city interactions a city had with other cities within the sub-system. Each interaction is represented by a stop within the route circuit(s) in which the city is found. This interaction number is then multiplied by the weekly flight frequency for each route circuit. An example of this interaction is as follows. If a route circuit is represented by Cities A-B-C-D-A and the frequency is three times weekly then City B has four legs in its circuit and on a weekly basis has a total leg interaction of 12.

From these circuits, sub-systems were determined on the basis of continued city interactions within the regional system of circuits. Each city within the circuits was analyzed individually to ascertain the number of circuits in which it was found. For example, Cities A-B-C-A, A-B-D-A, and A-E-F-A constitute three individual circuits. In this case the former two circuits comprise the sub-system, and the latter a separate sub-system due to its non-connectivity.

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[21] It should be noted at this time that non-scheduled operators (eg. air taxi, charter, and supplemental carriers) are not included in this analysis but that they are an important group of carriers throughout the state. Two further considerations which are of importance and which can be assumed are that these carriers are in competition with scheduled carriers on certain routes, and secondly, they are the carriers which are serving points not served by the scheduled carriers.

The assumption of this particular analysis with respect to the movement of goods, services, and people is that the greater the number of stops in a given sub-system, the greater the actual and/or potential interaction. Throughout this chapter it is also assumed that within any given system all aircraft serving that system have approximately the same capacity characteristics. For example, all aircraft are classified as small, having a carrying capacity which can range from one through 18 passengers, or carry a cargo load and/or a cargo-passenger mixture which does not exceed a maximum gross take-off weight of 12,500 pounds. It should be mentioned that the great majority of aircraft operating in the study areas are in fact of this size and capacity range.

The importance of this assumption is that it creates a hierarchial series of sub-systems within a given regional trade area. This hierarchy could then be used as a preliminary guide for regional economic and social development in the area, and it could also assist in the planning and implementation of a priority system for airport development and expansion.

To test what factors influence leg frequency in the sub-systems it was also assumed in this analysis that distance and population have the most direct effects on the number of legs within any given sub-system, therefore, correlation coefficients through the use of simple linear regressions were calculated to determine the degree of relationships existing between these two factors and the leg frequency factor. This was done also to determine if these relationships correspond to the theoretical gravity model in which interactions increase directly with population and decrease inversely with distance. In this case the factors of distance and population are the independent variables and the number of legs per week is the dependent variable.

With respect to correlations between population and leg frequency, an indicator of interaction, a strong positive relationship would mean an increase in interaction with an increase in population. It therefore could be assumed at this point that the population in the sub-system have strong economic and social ties with the regional center, and that the sub-system as a whole has a cash economy within its infrastructure that enables it to produce and maintain mobility and consumptive powers for its given population. It would also follow that if this relationship is positive there is little competition from other outlying regional centers competing for trade within this sub-system, given no other

modes of transport are available to and from the sub-system. On the other hand, an inverse or weak positive relationship could mean the existence of a weak per capita income within the sub-system's infrastructure, a sub-regional hub is also serving the sub-system's needs, existing competition from outside regional centers, transport via other modes of travel, poor airport and runway conditions, and various other economic and social factors.

To further support these latter assumptions of competition from other regional centers, correlation coefficients between the variables of distance and leg frequency were calculated for each regional sub-system. It was again assumed that a strong positive relationship suggests strong regional ties with the sub-system under consideration, and that competition is lacking. Here sub-system direction is an important criteria in this analysis. For example, in cases where regional sub-systems extend in the direction of another regional center, competition between the two centers should produce a weak positive or inverse negative relationship with increasing distance from the sub-system's regional center.

A final correlation between population and air cargo was also made for the Bethel and Nome regions. Here again many factors may influence the amount of cargo shipped via air. Some of these factors include the type of airport; runway characteristics such as runway length, navigation aids, duration of runway usage, and airport storage facilities. Other factors may include the community's economic infra-structure, the per capita income of the community, and other modes of transport competition. As a general indicator, however, the relationship between population and cargo is thought of as a good indicator of economic relationships at this level of study for air transport.

The analysis of interactions between cities was calculated by examining scheduled route circuits. To determine the number of interactions of individual cities with the regional center, the number of connecting flights per week between a particular city and the regional center were calculated. On the other hand, the number of cities connected to a particular city within a sub-system was determined by summing the total number of different cities which are connected within all of the route circuits serving that particular city.

The determination of these two forms of interacting linkages enabled the construction of hierarchial structures of regional cities situated within the various regional sub-systems. This analysis therefore served as a further break-down of the previous analysis pertaining to hierarchies at the regional sub-system scale.

Within a sub-system, the number of linkages between the regional center and other cities is the higher order linkage, the city having the greatest number of connections with the regional center being the dominant city. The number of cities which are connected within a particular city's air route circuit within the sub-system is the lower order linkage. This latter classification is important however, since these linkages are in fact good indicators of the extensiveness of actual and potential flows of goods and services. Thus in a regional planning context, the combination of these two flow indicators is important since the priority of socio-economic development might not be placed on a total system or sub-system but rather upon a more specific and localized city to city basis.

The Scheduled Air Route Networks of the Bethel-Nome Trade Regions

The air route system of the Bethel region is a more complex and integrated system than that of Nome. Within this regional system scheduled airlines operate in nine separate sub-systems serving a total of 37 cities having a total population of 9,851. Within the region the air route system connects with Bethel a total of 391 times weekly and has 1,582 weekly legs (See Figure 15 and Table 8).

The largest of the nine sub-systems in this region is Number 5. It extends in a south-southwest direction from Bethel. It contains a total of eight separate route circuits which connects a total of 11 different cities. These cities, excluding Bethel, account for 22% of the region's population served via scheduled airlines. The locations of settlements in this sub-system are mainly coastal. The cities of Eek and Tuntatuliak are important connecting points within the circuits, for if these cities were not connected the sub-system would become divided into two separate sub-systems. The cities of Eek and Tuntatuliak also interact with six other cities within the circuits of the sub-system, which is the highest number of interactions within the sub-system. As for the number of legs in Sub-system 5, there are 642 stops weekly. This accounts for 41% of the total air route

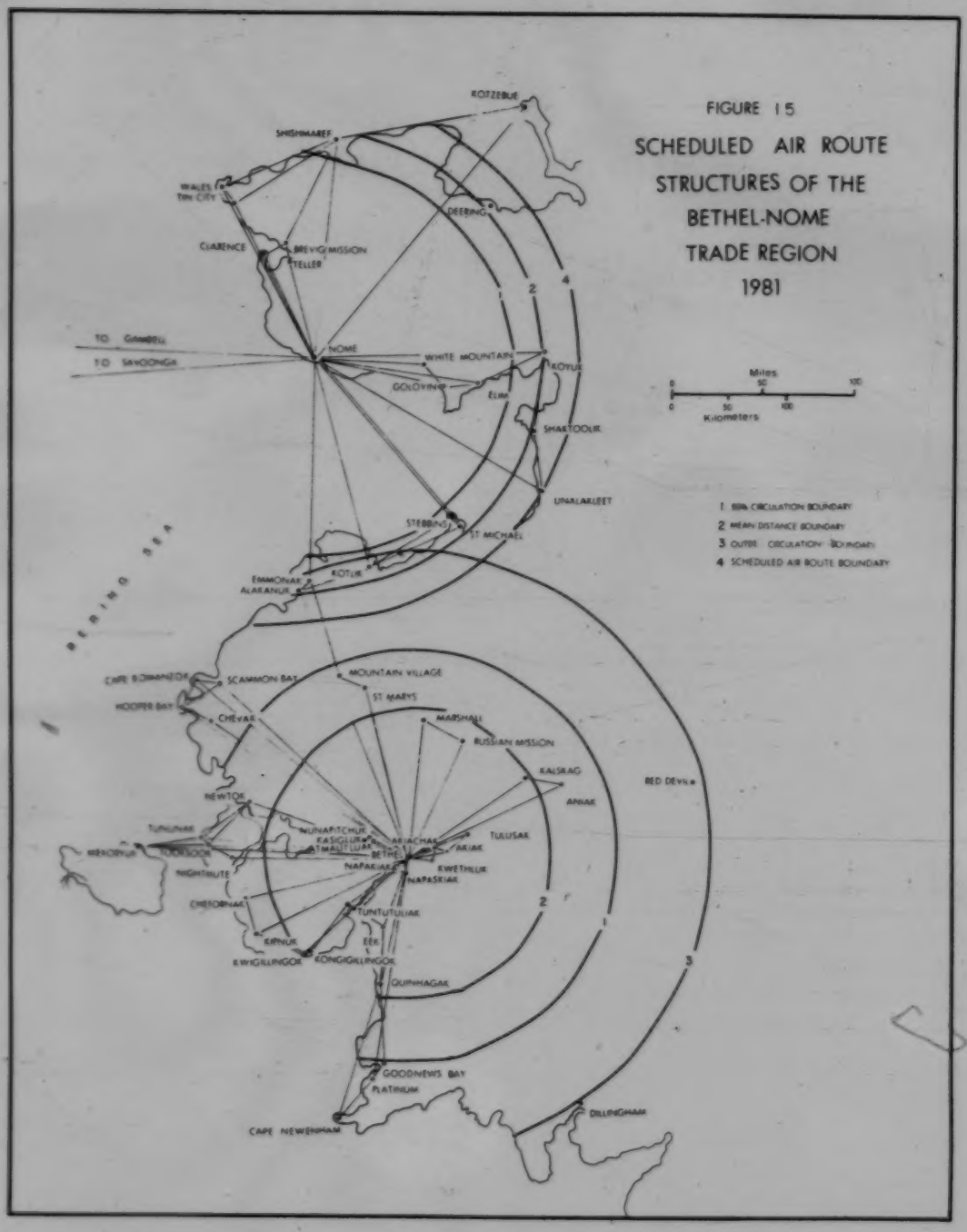

FIGURE 15

SCHEDULED AIR ROUTE STRUCTURES OF THE BETHEL-NOME TRADE REGION 1981

FINE PRINT

Table 8 Air Route Network for the Bethel Region 1981

Sub-systems Circuits	City Name	City Population	Distance from Bethel (Miles)	Weekly Frequency to Bethel	Number of Cities Served	Weekly Number of Stops in Route(s)	Average Cargo Deplaned Per Departure
Sub-system 1							
Bethel-Akiachak-	Akiachak	354	16	9	4	33	396
Kwethluk-Bethel	Kwethluk	444	12	9	4	33	504
Bethel-Kwethluk-Akiachak	Akiak	192	20	6	4	24	130
Akiak-Tulusak-Bethel	Tulusak	231	35	6	4	24	228
Bethel-Akiak-Tulusak Bethel		1,221		30		114	
Sub-system 2							
Bethel-St. Mary's	St. Mary's	436	100	12	4	54	3,437*
Mountain Village	Mountain Village	573	118	10	4	50	513
Emmonak-Alakanuk	Emmonak	556	173	10	4	50	485
Bethel	Alakanuk	533	165	10	4	50	445
		2,098		42		204	
Sub-system 3							
Bethel-Kalskag	Kalskag	382	75	6	2	18	504
Aniak-Bethel	Aniak	355	97	6	2	18	3,683*
		737		12		36	
Sub-system 4							
Bethel-Atmautulak	Kasigluk		35	3	3	(12)	
Nunapitchuk-Kasigluk	Nunapitchuk	100	25	9	3	30	495
Bethel	Atmautulak	186	30	9	3	30	281
Bethel-Nunapitchuk Atmautulak-Bethel		286		21		60	

* St.Mary's and Aniak cargo figures are high due to Boeing 737 service, and since they are served by jet they are not calculated with respect to cargo analysis.

Table 8 (continued)

Sub-systems Circuits	City Name	City Population	Distance from Bethel (Miles)	Weekly Frequency to Bethel	Number of Cities Served	Weekly Number of Stops in Route(s)	Average Cargo Deplaned Per Departure
Sub-system 5							
Bethel-Kwinhagak-Cape Newenham-Bethel	Cape Newenham	63	153	8	5	39	219
Bethel-Kwinhagak	Platimun	58	133	9	5	46	117
Goodnews-Platinum Bethel	Goodnews	248	121	9	5	46	347
Bethel-Eek-Kwinhagak	Kwinhagak	451	73	12	5	55	269
Goodnews-Platinum	Eek	307	40	11	6	48	249
Cape Newenham-Bethel	Tuntatulak	158	45	18	6	80	385
Bethel-Eek	Kongiganak	190	78	21	5	89	176
Tuntatuliak-Bethel	Kwigillingok	146	82	21	5	89	393
Bethel-Tuntatuliak Kongiganak Kwigillingok- Bethel	Kipnuk	325	97	18	5	75	237
Bethel- Tuntatuliak- Kongiganak- Kwillingok- Kipnuk- Chefornak- Bethel	Chefornak	204	96	18	5	75	318
Bethel- Kongiganak- Kwigillingok- Bethel		2,150		145		642	
Bethel- Kipnuk- Chefornak- Bethel							
Sub-system 6							
Bethel- Hooper Bay	Cape Romanzof	56	173	87	4	34	237
Cape Romanzof-Bethel	Chevak	461	138	12	4	53	405
Bethel-Chevak-Hooper Bay-Cape Romanzof	Scammon Bay	193	182	12	4	53	506
Scammon Bay-Bethel	Hooper Bay	648	155	15	4	62	441
Bethel-Chevak- Hooper Bay- Scammon Bay- Bethel		1,358		47		202	

Table 8 (continued)

Sub-systems Circuits	City Name	City Population	Distance from Bethel (Miles>	Weekly Frequency to Bethel	Number of Cities Served	Weekly Number of Stops in Route(s)	Average Cargo Deplaned Per Departure
Sub-system 7**							
Bethel-Fortuna	Fortuna	167	75	11	2	33	122
Lodge-Russian	Lodge						
Mission-Bethel	Russian		72	14	3	42	
	Mission						
Bethel-Marshall-Russian	Marshall	210	74	3	2	9	264
Mission-Bethel		377		28		84	
Sub-system 8							
Bethel-Napakiak-	Napakiak	307	10	6	2	18	284
Napaskiak-Bethel	Napaskiak	215	20	6	2	18	260
		522		12		36	
Sub-system 9							
Bethel-Tooksook	Mekoryuk	186	155	9	4	32	387
Tununak-Bethel	Newtok	154	97	10	4	35	306
Bethel-Tooksook	Nightmute	127	103	9	4	36	
Tununak-Newtok- Bethel	Tununak	299	119	13	4	40	660
Bethel-Newtok	Tooksook	336	116	13	4	49	431
Tununak-Bethel		1,102		54		192	
Bethel-Tununok- Mekoryuk- Bethel							
Bethel-Nightmute- Tooksook- Mekoryuk- Bethel							
Bethel-Nightmute- Tooksook- Newtok- Bethel							

**Marshall and Fortuna Lodge are combined tonnages for deplaned cargo.

infrastructure of the Bethel region. The total number of circuit interactions with Bethel on a weekly basis is 145 or 37% of the regional system's total. The cities of Kongiganak and Kwigillingok, each with 21 weekly connections with Bethel, are the highest interactors with the latter city.

The second and third most connected sub-systems are numbers two and six with 204 and 202 legs respectively. Spatially the two systems extend in a north-northwest direction from Bethel, and each serves four different cities within their respective circuits. The settlements served by these sub-systems are mainly coastal with some settlements in System 2 being riverine. As for the populations served by these sub-systems, System 2 has 2,098 inhabitants and System 6 has 1,358. These totals respectively account for 21% and 14% of the regional population base.

With respect to route circuits Sub-system 6 is the more complex with three circuits, while Sub-system 2 has only one. Within these two sub-systems there are 89 weekly flights to Bethel which account for 23% of the total route infrastructure of the Bethel region. The two largest interacting cities with Bethel in these two sub-systems are Hooper Bay in System 6 with 15 interactions and St. Mary's of System 2 with 12. It should be noted here that St. Mary's is a sub-regional hub of the region and is also serviced by jet aircraft.

The weakest interacting sub-systems with respect to leg frequency are Systems 3 and 8. System 3 extends to the northeast from Bethel and System 8 extends to the south. Each system has one route circuit which has 36 interacting legs per week and serves two different cities. As for service to Bethel each system is connected 12 times weekly. The combined population served by these sub-systems is 1,299 (excluding Bethel). This represents 13% of the region's total population base. Settlement locations in both systems are riverine. A second sub-regional hub for the Bethel region is located within Sub-system 3. This is the city of Aniak.

Intercity Connections

Inter-city connections with Bethel as listed by the 1981 Official Airline Guide are Anchorage, Fairbanks, and Juneau. Anchorage had 27 non-stop flights weekly to the regional center. Fairbanks and Juneau on the other hand, were listed as having 21

connecting flights per week. It is however possible to connect the full 27 times weekly from all points if time is of no essence.

Correlation Coefficients of the Bethel Region

Correlation coefficients within the Bethel region were calculated separately for five of the nine sub-systems, and combined calculations were made for Sub-systems 3,4,7, and 8 (See Table 9). This latter grouping resulted from an insufficient data base which would permit meaningful correlations on an individual sub-system basis. These latter systems are similar however, in that they all are characterized by simple route circuits, and are systems which serve areas not too distant from the regional center and have low populations within their systems.

By examining these regional systems as a total grouping the correlation coefficients in general depict the expected theoretical gravity model relationships of interactions increasing directly with population and inversely with distance although in some instances these relationships are weak. As for correlations between population and deplaned cargo, a fair overall relationship also exists.

The system showing the strongest relationships to all three categories is Sub-system 1. Correlation coefficients of 0.94 for population-leg frequency, -0.78 for distance and leg frequency, and 0.99 for population and cargo were found. Other sub-systems which show a strong correlation between population and leg frequency but a weaker correlation with respect to distance and leg frequency and also population and cargo are Sub-systems 6 and 9. Although further analysis of relationships were not conducted these three sub-systems do appear to strengthen the earlier stated assumptions that distance and direction from outside competition effects the strengths and weaknesses of interactions within the sub-systems. For example, all of the above three sub-systems extend in directions of competing regional centers and also show strong interacting relationships between population and leg frequency. The distance factor however showed somewhat weaker relationships. (The exception here is Sub-system 1 which appears to be a strong interacting sub-system close to Bethel.) As for population and cargo relationships, there appears to be a correspondence with newspaper circulations within the sub-systems. In this case Sub-systems 1 and 9 both

Table 9 Correleation Coefficients of the Bethel Air Network 1981

Sub-system Number	Population-Leg Frequency	Level of Significance*	Distance-Leg Frequency	Level of Significance	Population-Deplaned Air Cargo	Level of Significance
1	0.94	P<0.10	-0.78	P<0.30	0.99	P<0.01
2	-0.96	P<0.05	-0.73	P<0.30	0.99**	P<0.10
3						
4						
5	0.01	P>0.50	-0.48	P>0.50	0.15	P>0.50
6	0.87	P>0.20	-0.38	P>0.50	0.48	P>0.50
7						
8	0.44	P<0.10	-0.25	P>0.50	0.26	P<0.30
9	0.83	P<0.30	-0.25	P>0.50	0.66	P>0.50

*Excludes St. Mary's and Aniak due to jet service.

**To calculate the levels of significance the one-sample t test in the form of $t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$ (when H_o:P=0) was used. To determine the population correlation parameter (P), the two-tailed test was used in conjunction with degrees of freedom. Any P value which is lower than 0.05 is not significant and therefore the hypothesis :H_o is rejected and *vice versa*.

have high correlations and high newspaper circulations, while Sub-system 6 shows a weaker correlation and no newspapers delivered.

As for the correlation coefficients of the combined sub-systems (Numbers 3,4,7, and 8) an unexpectedly weak relationship was found to exist especially in the case of distance and leg frequency. Also found was a negative inverse relationship between population and leg frequency. These weak relationships could in part be due to the low settlement populations within the route circuits thus, creating less demand for goods and services, and in the case of Systems 3 and 7 to competitive air traffic from the sub-regional hubs of Aniak and St. Mary's respectively.

A similar negative but strong relationship was found in Sub-system 2 in addition to a highly correlated population-cargo relationship. In this instance it is possible that St. Mary's again is influential in creating these strong correlations. For example, it may be supplementing the movement of cargo within the area and at the same time diverting some of the Bethel traffic.

As for final consideration, Sub-system 5 is a special case since it shows the weakest relationships of all the sub-systems, while at the same time it is the most interactive sub-system in the Bethel region with respect to air system circuits and newspaper circulation. Correlation coefficients for this sub-system were 0.01 for population-leg frequency, -0.48 for distance and leg frequency, and 0.15 for population and cargo. Upon further examination of the data in Table 8 as to why this system lacks a relationship between population and leg frequency it appears that the circuits following and inclusive of Bethel-Eek-Tuntatuliak-Bethel have an excessiviely high number of leg frequency interactions for the population served within the area. To find specific reasons as to why these poor relationships exist, further examination is needed.

A further internal examination in reference to population and leg frequency within the sub-system was conducted however, to test the internal relationships within the system. This was done by splitting the sub-system into two sub-sets. The split was made at the Bethel-Eek-Tuntatuliak-Bethel circuit. The system was separated here for the following reasons. The population of both sub-sets is approximately equal, and it is the most appropriate circuit for splitting the system into two sub-sets. Within the divisional circuit described above, the city of Eek was included in the upper sub-set of circuits and

the city of Tuntatuliak was included in the lower sub-set. The correlation results do in fact suggest that the lower-sub-set does have a high leg frequency for the population served. The coefficient for this sub-set was -0.95, while the upper sub-set showed a strong positive correlation of 0.87, thus indicating an over supply of services within the lower sub-set. This could possibly imply that this is a competitive sub-set or possibly that the air carriers are using their smallest available aircraft within the size category defined earlier to service this area.

The Nome Air Route System

For the Nome region,Figure 15 shows the air route structure and Table 10 lists the air route sub-systems along with specific information with respect to their internal structures. The following conclusions are made by examinination of this table. In total the Nome region has scheduled air service to 19 cities with a total population of 5,346. There are four sub-systems serving this population base. Leg frequencies for the system total 482 weekly stops, and there are 152 weekly connections with Nome. Of the 19 cities receiving scheduled air service, 14 or 87% are located within the inner trade zone. Within the Nome region the largest and most dominant sub-system is Sub-system 2. Its air route structure serves a population of 1,011 inhabitants or 19% of the region's population. This sub-system has a total of 164 legs or stops per week within its system circuitry, and accounts for 35% of the total number of legs within the regional system of Nome. The sub-system has six cities which interact with Nome a total of 54 times weekly or 36% of the total regional air route infrastructure within the Nome region. Of these cities, Shishmaref is the largest and has 21 connections per week with Nome. It also has the largest number of interactions with cities other than Nome within the sub-system. This number of interactions is five. As for route circuitry of the sub-system, Shishmaref again ranks first with a total of 53 stops per week within its route circuits.

The second ranked sub-system in this region is Sub-system 3. This sub-system serves a population of 1,476 inhabitants or 28% of the region's population. In total the sub-system has 132 weekly legs which accounts for 27% of the total leg frequency within the system. The City of Elim which connects with five other cities is the largest

Table 10 Air Route Network of the Nome Region 1981

Sub-systems Circuits	City Name	City Population	Distance from Nome	Weekly Frequency to Nome (Miles)	Number of Cities Served	Weekly Number of Stops in Route(s)	Average Cargo Deplaned Per Departure
Sub-system 1							
Nome-Kotlik-Alaknuk	Alakanuk	533	130	2	3	8	445
Emmonak-Nome	Emmonak	556	125	2	3	8	485
Nome	Kotlik	305	120	4	5	16	265
Nome-Kotlik- St.	St. Michaels	283	128	6	3	20	620
Michaels-Stebbins- Nome	Stebbins	326	125	6	30	20	110
Nome-St. Michaels-		2,003		20		72	
Stebbins- Nome							
Sub-system 2							
Nome-Teller- Brevig	Pt. Clarence	25	78	3	3	12	0
Port Clarence-Nome	Teller	258	58	6	4	24	821
Nome-Teller-Brevig	Brevig	194	67	6	4	24	654
Shishmoref-Nome	Shishmoref	353	123	21	5	53	1,013
Nome-Shishmaref	Tin City	130	110	9	3	27	356
Kotzebue-Shishmaref-Nome	Wales	51	105	9	2	24	511
Nome-Shishmaref-Nome		1,011		54		164	
Nome-Shishmaref-Tin City-Nome							
Nome-Wales- Nome							
Sub-system 3							
Nome-White Mountain	White Mt.	115	62	6	3	21	581
Golovin-Nome	Golovin	118	78	6	3	21	445
Nome-White Mountain	Elim	288	95	6	5	24	596
Golovin-Elim-Nome	Koyuk	160	130	6	4	24	363
Nome-Elim-Koyuk	Shaktoolik	163	172	6	4	24	409
Shaktoolik-Nome	Unalakleet	632	147	6	3	18	2,162
Unalakleet-Shaktoolik-		1,476		36		132	
Koyuk-Nome							
Unalakleet-Nome- Unalakleet							
Sub-system 4							
Nome-Gambell-Nome	Gambell	447	197	21	2	57	551
Nome-Gambell-Savoonga-Nome	Savoonga	409	165	21	2	57	788
Nome-Savoonga-Nome		856		41		114	

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city interactor in this sub-system, and also has the largest leg frequency in its sub-system. All cities in this sub-system interact six times per week with Nome for a total of 36 weekly connections or 24% of the total Nome interactions. There is also a secondary or sub-regional hub in this sub-system. This is the City of Unalakleet. This sub-regional hub was determined by route circuits and service differentiation. For example, flights both originate and terminate at this city, thus indicating that it serves as a base of operations. Secondly, Unalakleet is served by jet aircraft.

Sub-system 4 is ranked third in the Nome region, and serves 16% of the region's population. The two cities served by Nome in this sub-system are Gambell and Savoonga. Both of these cities share with Shishmaref, the highest frequency of service with Nome. This number is 21 times per week. The main characteristic of this sub-system is that there are no other linkages within the system connecting with Nome, thus they are quite dependent on Nome in terms of interactions.

Sub-system 1 is the weakest system in the Nome region and serves 37% of the region's population. There are five cities in this system which interact with Nome a total of 20 times per week, or 13% of the total system interactions with Nome. There are a total of 72 stops within its circuits or 15% of the total system leg frequencies. The City of Kotlik interacts with five other cities within its route circuits. The two cities with the highest number of legs per week are St. Michaels and Stubbins.

Intercity Connections

As for inter-regional flights within Alaska, the cities of Anchorage, Fairbanks, and Juneau all have jet service to Nome a total of 26 times per week. Of these three cities, Anchorage is the dominating city since the majority of flights from Fairbanks and Juneau have an intermediate stop and/or change of plane service at Anchorage before continuing on to Nome. The City of Bethel is also listed as having three flights per week all of which originate and terminate at Nome.

Correlation Coefficients of the Nome Region

Correlation coefficients for three of the sub-systems in this region are shown in Table 11. In this system it is first noted that the theoretical gravity model expectations of

Table 11 Correlation Coefficients of the Nome Air Route Network 1981

Sub-system	Population-Leg Frequency	Level of Significance*	Distance-Leg Frequency	Level of Significance	Population-Deplaned Air Cargo	Level of Significance
1	-0.96	P<0.01	-0.25	P<0.20	0.26	P>0.50
2	0.81	P<0.05	0.65	P<0.20	1.00	P<0.05
3**	0.68(-0.63)	P<0.30	0.77(0.13)	P<0.20	0.40(0.96)	P>0.50

*To calculate the levels of significance the one-sample t test in the form of $t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$ (when H_o:P=0) was used. To determine the population correlation parameter (P), the two-tailed test was used in conjunction with degrees of freedom. Any P value which is lower than 0.05 is not significant and therefore the hypothesis :H_o is rejected and *vice versa*.

**Bracketed coefficients in Sub-system 3 are those which were obtained when Unalakleet was included in the analysis. Because Sub-system 3, which includes Unalakleet was expected to show a stronger relationship than originally found, further analysis was made. It was found that because Unalakleet is a sub-regional hub and because of its larger population size and jet cargo service, it biased the system and was therefore excluded in the analysis.

interactions (in this instance leg frequencies increasing directly with population and decreasing inversely with distance), are not consistantly displayed within the sub-systems. From this analysis it is noted that Sub-system 2 displays the strongest direct relationships between the independent variables of population and distance to the dependent variable of leg frequency and between population and air cargo. On the other hand, Sub-system 1 shows a strong inverse relationship between population and distance with that of leg frequency, and also weak positive relationship between population and air cargo. The importance of these relationships is that both Sub-systems 2 and 3 show direct relationships between the independent variables of population and distance with the dependent variable of leg frequency. These coefficients respectively are 0.81 and 0.65 for Sub-system 2 and 0.68 and 0.77 for Sub-system 3. This is the type of relationship which could be expected when there is no other regional center in the area competing for territorial trade along with a mobile population that has no other mode of transport available to them. In the case of Sub-system 1, there is a strong inverse relationship between population and leg frequency and also a weaker inverse relationship between distance and leg frequency. These coefficients are -0.96 and -0.25 respectively. This relationship therefore could result from the presence of a competing center whose trade is also in the direction of the existing air network extending from Nome. In this case Bethel is the competing center.

The relationships between population and air cargo for each sub-system show considerable variation with Sub-system 2 showing a positive relationship of 0.90 while Sub-systems 3 and 1 have coefficients of 0.40 and 0.26 respectively. Possible factors other than social and cultural --such as degrees of subsistence living, which could be influencing the strong correlation in Sub-system 2 are the mining and fishing industries. The weaker relationships of Sub-systems 3 and 1 could be related to poor air field conditions or to ocean transport since the area lies both in the path of ocean freightage to Nome and also along the Yukon River freight system.

The Juneau-Ketchikan Air Route Network

The scheduled airline route structure of the Juneau trade region is shown in Figure 16. The route structure characteristics are shown in Table 12. It consists of six

FIGURE 16

SCHEDULED AIR ROUTE STRUCTURES
OF THE JUNEAU-KETCHIKAN
TRADE AREAS-1981

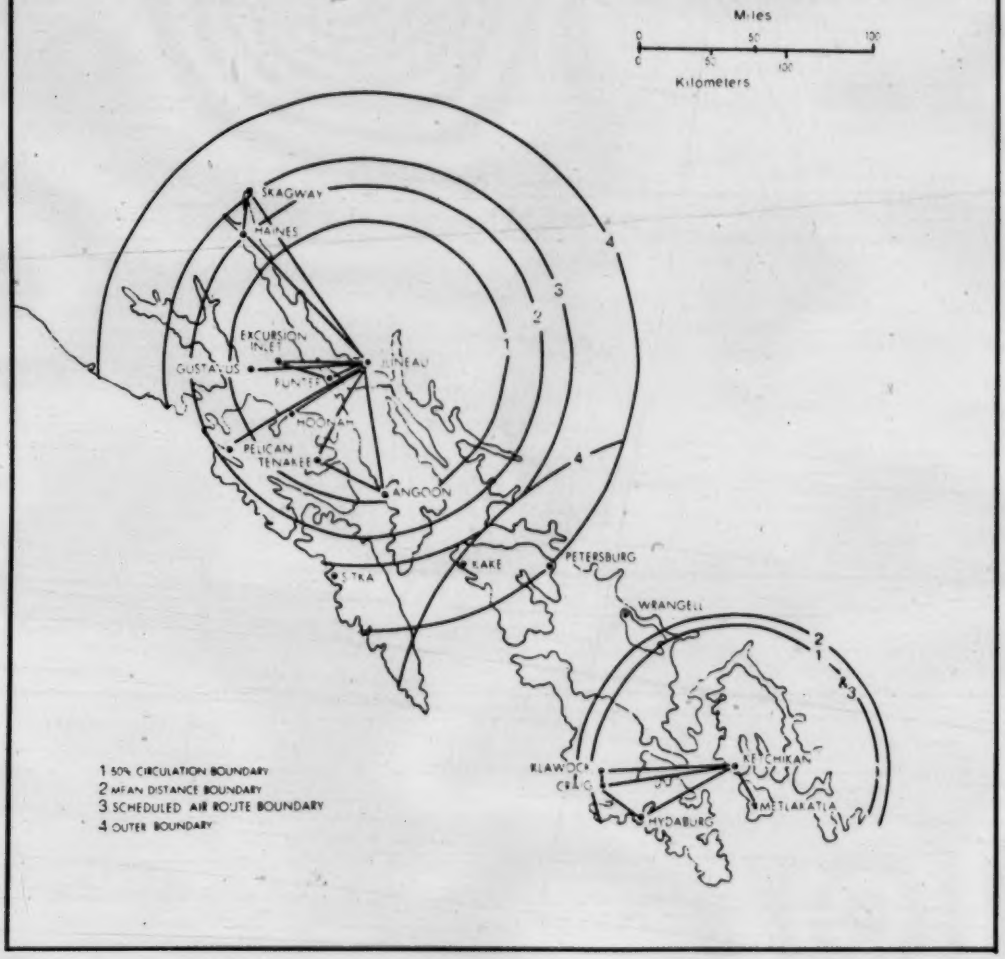

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Table 12 Air Route Network for the Juneau Region 1981

Sub-systems Circuits	City Name	City Population	Distance from Juneau (Miles)	Weekly Frequency to Juneau	Number of Cities Served	Weekly Number of Stops in Route(s)	Average Cargo Deplaned Per Departure
Sub-system 1							
Juneau-Angoon-Tenakee	Angoon	527	58	6	2	18	494
Juneau	Tenokee	134	48	6	2	18	208
		661		12		36	
Sub-system 2							
Juneau-Funter Bay-Excursion Inlet-Juneau	Funter Bay	12	19	1	2	3	33
	Excursion Inlet	23	38	1	2	3	721
		35		2		9	
Sub-system 3							
Juneau-Hoonah-Juneau	Hoonah	1093	40	49	1	98	146
Sub-system 4							
Juneau-Gustavus-Juneau	Gustavus	107	50	2	1	4	293
Sub-system 5							
Juneau-Pelican-Juneau	Pelican	221	70	6	1	12	395
Sub-system 6							
Juneau-Haines-Skagway-Haines-Juneau	Haines	1,366	75	77	2	140	
Juneau-Skagway-Haines-Juneau	Skagway	877	87	77	2	189	
Skagway-Haines-Juneau		2,243		154			
Sub-system 7*							
...Wrangell-Petersburg-Sitka Juneau...	Petersburg	3,197		7	2	14	553
	Sitka	8,787		14	1	14	555
...Sitka-Juneau...	Wrangell	3,152		7	3	21	201
...Yakutat-Juneau...	Yakutat	442		7	1	7	2,110
		15,578		35		56	

*Because this analysis is on the immediate Juneau air service region and because circuits are not complete (A-B-A) structures within this region, these totals are not calculated in this analysis.

sub-systems which serve a total of nine cities with a combined population of 4,360. This excludes the population of Sub-system 7.[22] If this system were included in the population count within the service region, it would increase the system population to 19,938. Thus, this sub-system by itself would contain 78% of the total sub-system population within its network. This would then mean that the other six regions combined would contain 22% of the serviced population. This point is brought out here to emphasize the importance of all jet service in this region which connects the larger cities as well as the more distant and isolated village of Yukatat in the extreme northern part of 'Southeastern' Alaska.

Distances between the outlying cities and the regional center of Juneau are quite close with the closest city being 30 kilometers (19 miles) distant and the farthest only 139 kilometers (87 miles). In total there are 225 frequencies to Juneau, and 488 stops, within the six regional sub-systems. Individual circuit frequencies on a weekly basis to Juneau within the air network range from one flight per week to 154 flights per week. The overall complexity of this system is quite simple with no route connecting with Juneau having more than two cities within its circuit.

Of the six sub-systems, Number 6 is by far the most strongly developed. The two cities contained in its circuits are Haines and Skagway, both of which are situated northwest of Juneau. These two cities alone contain over 51% of the air network's serviced population. The circuits in this sub-system also contain the majority of frequencies to Juneau and the number of stops made. As for the former, there are 154 frequencies or 68% of the system's total and the latter contain 329 stops for 67% of the total.

The second ranked sub-system is Number 3. It contains one city within its single route circuit. This is the City of Hoonah to the southwest of Juneau. Hoonah's population is 1,093 and accounts for 25% of the region's population. It has 49 weekly frequencies to Juneau or 22% of the region's frequency total.

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[22] The analysis of Sub-system 7, except for a brief mention as to its population base and frequency to Juneau on intercity route connections will be excluded in this analysis. This exclusion is made for two reasons. First, its circuits are all serviced by jet aircraft; second, the cities listed in the route circuits are all intermediate points between origins and destinations of inter-state service.

This is followed by Sub-systems 1, 5, 4, and 2. The latter sub-system is the least developed. It has less than 1% of the network's population and frequencies to Juneau and only 2% of the sub-system's legs.

Intercity Connections

The interstate route circuits which flow through 'Southeastern' Alaska connecting the cities of Ketchikan, Wrangell, Petersburg, Sitka, and Yakutat seem quite well developed considering these routes are served by the larger Boeing 727 and 737 aircraft. Of these 'Southeastern' cities, the regional center of Ketchikan, with 21 weekly connections of which seven are direct non-stop, has the greatest number of connections to Juneau. Sitka is the second ranked city with 14 direct connections. This is followed by Petersburg, Wrangell, and Yakutat, each of which have seven flights weekly to Juneau.

Of the regional cities within Alaska but outside of the Southeastern region, the city of Anchorage with 37 connections (25 of which are non-stop) to Juneau is the highest interactor. This is followed by Fairbanks, which also has 37 connections, but since all of the routes connecting it with Juneau involve intermediate stops it is considered to be a lower order than Anchorage. The two ranked interactors with Juneau are Bethel and Prudhoe Bay, both with 23 flights weekly. Third ranked are Kotzebue and Nome with 21 weekly connections. As shown in this analysis, interstate service connecting points within Southeastern Alaska and to other regions of the state seems quite well developed especially when large jet service is considered.

The Ketchikan Air Route System

The Ketchikan air route network is the simplest network in this study as it contains only two sub-systems serving a total of four cities. The total population served by these two sub-systems is 2,490. This air network, like that of Juneau, also contains all jet service through the region. This sub-system is shown in Table 13 as Sub-system 3, is likewise treated as Sub-system 7 was in the Juneau air network.

If Sub-system 3 were included in the air network surrounding Ketchikan the total population served would increase to 17,626, and Sub-system 3 would then constitute

Table 13 Air Route Network of the Ketchikan Region 1981

Sub-systems Circuits	City Name	City Population	Distance from Ketchikan (Miles)	Weekly Frequency to Ketchikan	Number of Cities Served	Weekly Number of Stops in Route(s)	Average Cargo Deplaned Per Departure
Sub-system 1							
Ketchikan-Annette Ketchikan	Annette	1,200	20	32	1	64	171
Sub-system 2							
Ketchikan-Hydaburg-Craig	Hydaburg	380	48	53	3	149	201
Klawock-Ketchikan	Craig	587	56	67	3	163	109
Hydaburg-Ketchikan	Klawock	323	27	67	3	198	65
Ketchikan-Craig-Ketchikan		1,290		187		510	
		2,490		219		574	
Inter-state Routes							
Sub-system 3							
..Sitka-Ketchikan..	Petersburg	3,197		7			
..Petersburg-Wrangell	Sitka	8,787		7			
		15,136		21			

86% of the total population base. This would leave Sub-systems 1 and 2 with 14% of the serviced population. This southern area of 'Southeastern' like that of its northern counterpart Juneau, is therefore heavily dependent on all jet services which connect the larger cities of the region.

In total Sub-systems 1 and 2 have 219 weekly flights to Ketchikan and a total of 574 stops in their route circuits. This network, like that of the Juneau, system has both a local air service region and high frequency service to the regional center. As for the system's local nature, the city of Craig is the farthest point served. It is 90 kilometers (56 miles) from Ketchikan. The two cities with the highest frequency to Ketchikan are Craig and Klawock, both with 67 flights weekly.

Of the two sub-systems, Number 2 is the most complex. It has 1,290 inhabitants within its structure. This accounts for 52% of the system's populations. There are three interacting cities within this sub-system, each of which interact with three cities. It has 187 weekly interactions with Ketchikan which is 85% of the system's total interaction. The leg frequencies of this sub-system total 510 for 89% of the system's total. Sub-system 1 has only one route circuit which connects the city of Annette to Ketchikan. This city is however important as it has the largest population of the regionally served cities (excluding those with jet service). It also has a relatively large service frequency to Ketchikan.

Intercity Connections

With respect to intercity connections with other major centers of the state it is interesting to note that the Official Airline Guide (1981) lists Anchorage, Fairbanks, and Juneau as connecting centers. The former two have seven weekly connections and Juneau has 21. A reasonable assumption from this analysis is that this southernmost regional center has a less important relationship with the smaller regional centers of the state (eg. Bethel-Nome).

C. Summary

In summary, this chapter has served several purposes. It has first helped to define a new set of regional boundaries through the delineation of scheduled air route networks (excluding jet service) of four previously defined newspaper trade regions. Secondly, through the analysis of the number of stops in a regional route structure a ranked dominance of regional sub-systems was established. Also cities in each sub-system and within the total system were analyzed to determine the number of weekly flight frequencies to their respective regional centers, and which cities have the greatest number of interactions within their respective route systems.

Some of the important findings in this chapter are as follows. On a system-wide base the general trend is from less complex and more local air route structures in the southeastern area of the state to more complex and distant systems in the North. The highest number of regional sub-systems are in the Bethel region and the lowest numbers are found in the Ketchikan trade area. These same findings hold true on a north-south basis for the number of cities served within each region and for city interactions within the regions. This north-south phenomenon is probably the result of two contrasting characteristics of the regions. First is the abundance of all-jet services which connect the larger cities in the southeastern region. Secondly, the number of small and dispersed settlements is far greater in the northern region of Bethel and Nome as compared to Juneau and Ketchikan.

A reversed situation however exists with respect to frequency of service from individual cities to the regional centers. Here the southeastern regions have much higher frequencies than those of the northern regions. Again the greater population size of individual cities in 'Southeastern' Alaska probably contribute significantly to this phenomenon.

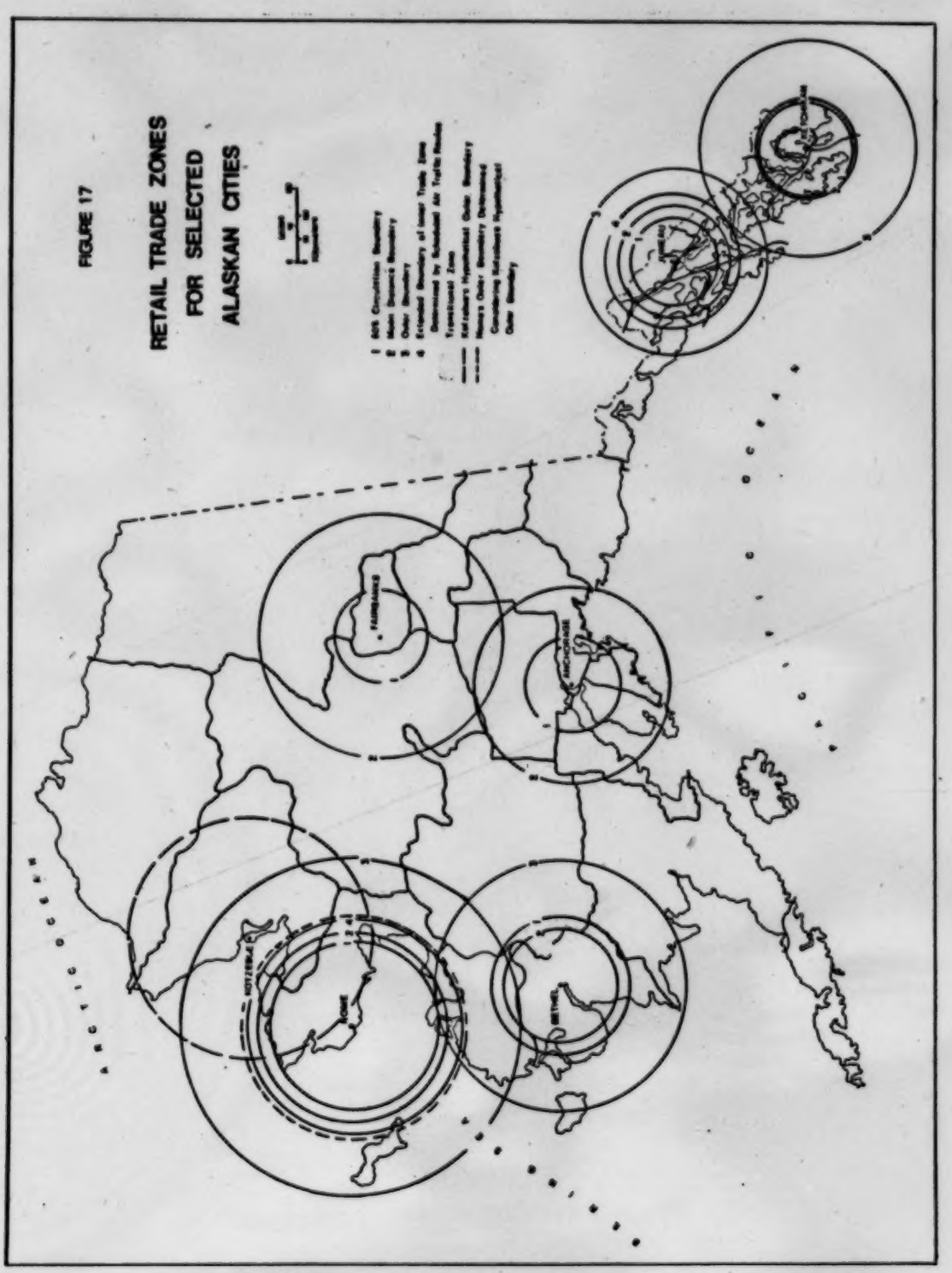
As for inter-state jet service between Alaskan cities, Anchorage is by far the most dominanat city with respect to interactions. Of the four regional centers listed by the Official Airline Guide (1981) the city of Juneau has by far the most inter-state connections to it while Ketchikan has the least. Reasons for these situations are probably as follows. Juneau's position as the state capital requires greater numbers of intercity interactions. Ketchikan, on the other hand, due to its extreme southerly location in the

state, is more tied to the immediate southeastern region and to out-of-state cities such as Seattle and Portland.

As for regression analysis done for the Bethel-Nome region, it was found that the theoretical gravity model expectations showed a general associative relationship with respect to correlation coefficients between the dependent variable of leg frequency and the independent variables of population and distance. There were, however, several sub-systems which displayed a weak or non-existent correspondence between one or both sets of tested variables. The strongest sub-system correlations were found to exist in Sub-system 1 of Bethel. Thus with regards to the number of leg frequencies of a given system more influential factors other than population and distance must be examined. For example, runway length, duration of airport operation, per capita income of the village along with other socio-economic characteristics of its infrastructure, and lastly, competition from non-scheduled air carriers and other modes of transportation could be analyzed.

With respect to correlation coefficients between the dependent variable of cargo and the independent variable of population, the same type of weak and non-existent relationships were found.

Finally, three sets of variables however, did show a correspondence between the strength of newspaper circulations and the direction of Sub-system route flows. Here it was found that sub-systems showing stronger coefficients were those where newspaper circulation was strong and route direction was away from competing centers and *vice-versa*.



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V. A Comparison of Newspaper Trade Boundaries and the Scheduled Air Route Networks

As a last comparative analysis, the same delineated newspaper trade area boundaries that were defined in Chapter III from Reilly's breaking-point formula were also used in this chapter to compare actual and theoretical service boundaries of regional air systems. The end result of this analysis is shown in Figure 17 which shows on one map the new set of regionally difined trade boundaries for the tertiary sector of the Alaskan economy. It should be remembered at this time that the circular delineated boundaries shown in Figure 17, as well as in all previous figures, are theoretically derived boundaries. They should be used only as a general guide for preliminary planning purposes. This point is brought out due to the fact that population distribution within these boundaries is not uniform. Therefore, if planning in great detail is desired, reference should be made to the appropriate tables and figures to determine where within these regions the population is located.

A. A Comparison of Newspaper Boundaries and the Bethel Air Route Network

A comparision between the combined newspaper-air service structures in the Bethel region, produced the following. First, with regards to the pre-determined trade area derived in Chapter III, the present air route structure was so close to the determined outer boundary of newspaper trade that the same line could be used for the outer delineation of regional trade. At the same time it was also noted that the inner zone of newspaper trade delineated by the 50% circulation boundary, contained 26 cities or 70% of the cities served by air in the region. This left 11 cities with air service in the outer zone. The breaking-point derived from Reilly's law was also in close approximation to the outer zone being less than 48 kilometers (30 miles) distant.

By cross-referencing cities listed as receivers of newspapers in the Bethel region (Table 4) with those of cities receiving air service (Table 8), it was found that Sub-system 6 was a receiver of no listed newspapers and that Sub-systems 5 and 9 were the highest receivers, both these sub-systems receiving 140 issues per edition. It is interesting to note that Sub-system 9 lies in a westerly direction from Bethel, a

Table 14 Selected Characteristics of the Bethel Trade Region 1981

Sub-system Number	Number of Papers Delivered in Sub-system	Population of Sub-system	Distance Between Bethel and the Closest Settlement (Miles)	Distance Between Bethel and the Farthest Settlement (Miles)	Total Weekly Frequency	Weekly Frequency to Bethel	Location Characteristics of the Sub-system
5	140	2,150	40	153	642	145	coastal
9	140	1,120	97	155	192	54	coastal
1	100	1,221	12	35	119	30	riverine
2	80	2,098	100	165	209	42	coastal
3	80	737	75	97	36	12	riverine
4	40	286	25	35	60	21	riverine
7	40	377	72	75	84	28	riverine
8	40	527	10	20	36	12	riverine
6	0	1,358	138	182	202	47	coastal

direction in which no other regional competition exists. This same situation holds partly true for Sub-system 5 which can be divided into a southerly and a southwesterly sub-set (See Figure 15.). Here the total system received 140 issues, but upon further inspection one finds that the more southerly circuits were by far weaker with respect to newspaper coverage even though each divided sub-system had approximately 1,000 inhabitants. Within these southern circuits only Quinhagak with 40 issues per edition was listed as a receiver of papers. On the other hand, the southwest circuits contain three cities to which 100 papers are delivered. The weakness of this southerly system can in part be assumed to be the result of competition from the sub-regional hub of Dillingham, which lies in an easterly direction from the more southerly points of the sub-system.

Finally by examining the total readership in individual settlements which lie within their respective sub-systems (Table 14), a general conclusion which could be drawn is that the closer the sub-system is to the regional center, the less developed are the route circuits and leg frequencies and also the less the newspaper circulation by the settlements within the sub-system. At the same time it is also noted that these settlements have a riverine location. On the other hand, route structures and newspaper circulations are more developed as distance increases from the regional center and cities have coastal locations as well as greater population concentrations. The two exceptions to this are Sub-systems 1 and 6. It is probable that Sub-system 1, which is the closest urban concentration to Bethel is an area of interacting satellite communities with the regional center. As for Sub-system 6, no explanation can be found for the absence of newspaper circulation, other than survey incompleteness. It is observed however, that the route system is well developed and the area served is coastal in nature.

A Comparison of Newspaper Boundaries and the Nome Air Route Network

By examining Figure 16 which shows the delineated newspaper boundary of the Nome region and the present air route structure it becomes evident that the latter has a close relationship with the defined inner zone newspaper boundary. The two major extensions of the air route system (excluding Kotzebue, Gambell, and Savoonga) are the cities of Koyuk and Unalakleet. The City of Kotzebue is considered a regional air traffic

Table 15 Selected Characteristics of the Nome Air Route Network 1981

Sub-System	Population Served	Number of Papers Circulated	Distance to Closest Settlement (Miles)	Distance to Farthest Settlement (Miles)	Leg Frequency	Weekly Frequency to Nome	Location Characteristics of the Sub-system
1	2,003	2	125	130	72	20	coastal
2	1,011	26	58	123	164	54	coastal
3	1,476	36	62	172	132	36	coastal
4	856	24	165	197	114	42	island

hub in this analysis and is therefore not included as a part of the Nome region. Gambell and Savoonga on the other hand, are part of the Nome region but because they are located on St. Lawrence Island, which is some 200 miles from Nome, they are not considered in the analysis due to their isolated locations. By including the cities of Koyuk and Unalakleet in the trade area, a new extended inner trade zone boundary was derived. This new boundary is at a distance of 235 kilometers (147 miles) from Nome, and places the trade zone in closer approximation with the Nome-Bethel breaking-point derived from Reilly's law. Also noted at this time is the close approximation of the extended boundary and the hypothetical outer trade zone boundary of Nome if Kotzebue's hypothetical trade area is included. This new boundary is shown in Figure 16 and in Figure 17.

The examination of Table 15, showing route sub-system characteristics and newspaper circulations within these sub-system shows that all sub-systems serve coastal locations and that the two strongest interacting sub-systems to the north and east of Nome are the two areas of stronger newspaper circulation. It also shows that the weaker route system to the south corresponds to the weaker area of newspaper circulation. Also, the strongest sub-systems are those which have the greatest variations in mileage between points in the route circuits, and they both serve a smaller population base.

A Comparison of Newspaper Boundaries and the Juneau Air Route Network

A comparison of the newspaper trade region with that of the scheduled air route network as shown in Figure 16 and Table 16 reveals the following. There are only five cities in the region receiving newspapers from Juneau, and of these five cities, one is located on the extreme outer boundary line of newspaper trade. This is the City of Petersburg, which as mentioned earlier, is not part of the defined regional air network. The other four cities do however have connections with the regional centers. Noteworthy here are Sub-systems 6 and 3, which contain the cities of Haines, Skagway, and Hoonah, as these are the two most developed air sub-systems in the region. Furthermore when grouped as one they receive 75% of Juneau's regional newspaper

Table 16

Selected Characteristics of the Juneau Trade Region 1981

Sub-system	City	Population	Number of Papers Circulated	Distances Between Center and Juneau (Miles)	Leg Frequency	Frequency to Juneau	Direction from Juneau
6	Haines	1,366	25	75	140	77	northwest
6	Skagway	1,877	25	87	189	77	northwest
3	Hoonah	1,093	25	40	98	49	southwest
1	Angoon	527	25	58	18	6	south
7	Petersburg*	3,197	10		14	7	southeast

*Petersburg is not included in the analysis.

Table 17

Selected Characteristics of the Ketchikan Trade Region 1981

Sub-system	City	Population	Number of Papers Circulated	Distances Between Center and Ketchikan (Miles)	Leg Frequency	Frequency to Ketchikan	Direction from Ketchikan
1	Metlakatla	1,200	150	20	14	32	south
2	Hydaburg	380	62	48	149	153	west-southwest
2	Craig	587	56	56	163	67	west
2	Thorne Bay		56	45			west
2	Klawock	323	27	58	198	67	west
2	Kake	679	20	145			northwest

circulation. Another interesting observation is that both these sub-systems extend from Juneau in directions which are away from other potential competing centers to the south and southeast.

By comparing and analyzing the pre-determined newspaper boundaries of the Juneau trade region with those of the present air route structures of the region in Figure 16 it is noted that the two systems correspond very well. The one exception which lies outside of the inner zone's outer boundary is the City of Skagway. Thus the inner trade zone's outer boundary is extended by 19 kilometers (12 miles). This extension is shown in Figure 16 and Figure 17.

It is also noteworthy that the regional air route structure is totally contained within the inner zone. This characteristic therefore produces a service region which is quite local in nature. With respect to the breaking-point derived from Reilly's law there is no change in the position of the outer boundary line. This is probably due to the interstate jet service providing connections to Juneau from the larger outlying center of Petersburg.

A Comparison of Newspaper Boundaries and the Ketchikan Air Route Network

A comparison of the Ketchikan newspaper trade zones with those of the air network in the region is shown in Figure 16 while specific characteristics of these two criteria are listed in Table 17. Analysis of these two criteria first of all reveals a strong correspondence between the air route structure of the area with that of the inner trade zone of newspaper circulation. The only city listed as receiving newspapers which is outside this zone is the city of Kake which is located at the extreme outer boundary of newspaper circulation.

Within the inner trade zone, only one city is listed as receiving newspapers which does not have scheduled air service. This is the settlement of Thorne Bay which is located west northwest of Ketchikan. Within the inner zone the cities which lie in the south to west sector receive 80% of the listed newspaper circulation. Thus direction away from other regional and sub-regional centers is again evident.

B. Conclusion

In summary, a comparison and analysis of the combined newspaper trade region and the air route systems for each region were examined. This was done to determine the degrees of correspondnce or differences between the two trade areas, and to provide a final and more cohesive tertiary trade area for each of the four regions studied. The final defined trade regions as shown in Figure 17 thus incorporate both the boundaries delineated by newspaper circulation and those of the air routes. The maximum areal extent of trade for the inner and outer boundaries was defined by either of the two indicators.

By comparing the two regional trade areas of newspapers and air routes, the strongest correspondence between the two regions was found to be within the inner trade zone of newspaper circulation[23]. This was especially found to be especially true for the southeastern regions and the Nome region. With respect to the Bethel region, 70% of the cities served by air were found within this inner zone. The exception of Bethel's slight non-conformance between the two boundaries is an indication of its regional importance as a communications and trading center.

Finally, through a combined analysis of newspaper circulations and specific sub-system characteristics within each regional trade area, it was found that direction and location are related to sub-system development. Specifically, it was found that sub-systems which are in directions away from their regional center have stronger and more complex development of their route circuits. In the case of the two northern regions it was also found that newspaper circulation and air routes serving coastal settlements were more strongly developed.

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[23] An interesting observation which has revealed itself in this analysis is the lack of service to points outside the inner zone by scheduled operators. These points outside the inner zone can therefore be assumed to be served by the non-scheduled operators.

VI. Conclusions

Various regionalization schemes have been made for regional planning purposes within Alaska and a variety of studies have been completed by institutions and professional persons, but geographic studies of the state's tertiary sector of the economy have been lacking.

This study has provided a new set of regional boundaries based on the identification, examination, and delineation of retail trade areas through the use of two indicators. These are newspaper circulations and scheduled air route networks within the state.

These two indicators and their delineated boundaries have incorporated certain concepts and indices which have been used in previous studies which have defined regional boundaries or linkages through interaction of inter-regional and intra-regional flows.

It is believed that through the use of these two indicators and the methods used to delineate their boundaries that newspaper circulations and air route networks are very useful indicators of economic and social interaction within and between trade areas.

Although it is acknowledged that no one regional boundary is static through time in depicting the spatial extent of certain phenomenon, there are certain strengths associated with these combined indicators that render them as very useful guides for preliminary regional planning and business planning purposes. This should be particularly true for city development, airport and warehouse planning, and for the establishment of new marketing areas. These strengths are outlined below.

Newspaper circulation is a good approximation of the maximum extent of retail trade areas. It also shows the variation in the number of circulations among the receiving centers. Through statistical analysis of deviations in newspaper circulations defined areas of varying strengths of interaction can be described and located by zonal boundaries. These zonal boundaries can also be combined to produce a meaningful interaction zone whose internal area can be defined as an area of transitional fluctuation. This zone therefore does in general terms depict an area of dynamic quality.

The analysis of scheduled air route networks in a near roadless area serves as a strong indicator of interaction between cities situated within a route network. It also indicates the particular degrees of interaction between pairs of cities in different air route networks. When this indicator is combined with newspaper circulation zones a more cohesive and integrative marketing region of the state's tertiary sector is defined. It logically follows that if these two indicators and their indices of measurement (distance, direction, frequency, and location) show degrees of interaction between places, then it is also a meaningful measure of isolation both socially and economically. Although Anchorage and Fairbanks claim extensive areas of the state for retail trade purposes, there are other identifiable trade areas extending from other regional centers. Of the other regional centers, Nome has the largest trade area, but this is somewhat deceiving since the number of settlements in the area is small as are the settlements' populations. In fact, an analysis of the Nome Nugget's circulation reveals it is an important out-of-state newspaper. Probable factors causing this peculiarity are tourism and mining and transient labor force in the area.

Another paper, The Ketchikan Daily Times, has an important out-of-state circulation, especially to the state of Washington. It sends more papers there than it sends to Anchorage.

As for regional trade boundaries of all the regional centers, it was also found that the cities of the more urbanized areas which have inter-city road networks (Anchorage, Fairbanks, Juneau, and Ketchikan) have 50% circulation boundaries which approximate one hour commuter times by automobile travel and that the more isolated areas of non-urbanized characteristics which in general to not have inter-city road networks have 50% circulation boundaries which are two times as large. .

In general, it was also found through analysis of newspaper circulation and population counts within the trade regions that newspaper readership is quite weak and that a large number of inhabitants do not receive news via newspapers.

Also through examination of trade zone boundaries an area where a trade zone void exists was revealed. This area is located in the Kuskokwim census division. It is an area of no newspaper circulation.

With respect to the breaking-point formula derived from Reilly's law, it was found in all cases that the breaking-points were located inside of the outer trade zone boundaries, and that these breaking-points perfectly depicted the retail trade zones between the Anchorage-Fairbanks trade region. Also a close approximation was found to exist in the Juneau-Ketchikan trade area. With respect to the Bethel-Nome breaking-point an overlapping zone exists between the two regions, but in general it is a fair approximation. Other breaking-point combinations between regional centers were not as exact. The problem here was mainly the extreme differences in population sizes of the centers and to some extent the very large distances involved.

From the analysis defining air route sub-systems through the identification of air route structures and frequencies of interaction for the Bethel-Nome and Juneau-Ketchikan trade regions, and comparing them to the defined newspaper circulation regions, the following points were found. In general, the trend reveals that as one moves north from Ketchikan, the air route systems become more complex in the number of sub-systems and route circuits, and the trade areas become larger. On the other hand, the two 'southeastern' systems rank highest in individual city connections with their respective regional center. A probable contributing factor to the route simplicity in 'Southeastern' Alaska is jet air service which connects all the larger centers in the area.

With respect to the most developed sub-system within each region, Sub-system 5 was the most developed interacting sub-system of the nine which service the Bethel region. Of the four sub-systems in the Nome region, Sub-system 2 is the first ranked sub-system. In 'Southeastern' Alaska there is a total of six sub-systems. Juneau's most developed sub-system is Number 6. The most southern trade region in 'Southeastern' is the Ketchikan trade area. It has only two sub-systems of which Number 2 is the most interactive.

Through the comparison of air routes and newspaper circulation, three major corresponding characteristics were found. First, regions of scheduled air traffic strongly correspond to the inner trade zones of newspaper circulations. Secondly, the strongest air route sub-systems correspond with the strongest areas of newspaper circulations. Thirdly, directions from the regional center appear to correspond to the relative strengths and weaknesses of both regional indicators. This latter characteristic is related

to competitional effects from other regional centers.

As a final comment concluding this study, it was not intended to be a rigorous study of economic and social modeling for planning purposes. It was rather intended to be a study of regional interaction by which such modeling can be instituted. It is hoped that this new regional division of Alaska will aid in the process of future planning in the state and at the same time interest others to explore alternative means and methods of regionalization with criteria that meets the needs of their specific goals.

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Appendix A

December 5, 1975

Dear Sir:

I am currently engaged in a study of communication networks in Alaska and northern Canada which will become a segment of my masters degree thesis pertaining to settlement in the North.

I would appreciate any information you could send me pertaining to the circulation of your newspaper. Specifically, I would like to know the following:

1. During the year of 1974, what was your total number of newspapers published?
2. In 1974 how many newspapers were circulated in your town?
3. What other settlements–villages, towns, and cities did you send newspapers to on a regular basis in 1974?
4. How many newspapers did you send to each of these places in 1974?
5. I would like to have the same questions answered for 1973 also.

Your cooperation will be greatly appreciated as your information will be of great value to me.

Sincerely,

Kenneth A. Holm
Mod 416E Univ. of Alaska
Fairbanks, Alaska 99701

Appendix B

February 3, 1976

Dear Sir:

This letter pertains to the revision of the letter enclosed, dated and sent to you on the fifth of December, 1975. It has become apparent to me that my questions asked of your newspaper circulation are worded rather vaquely, and as a result, I am receiving inadequate or wrong information.

To correct this error, I have rephrased these questions and have shown an example of each, with the type of answer I would like. Question one is the most important and I would like to know these figures as close as possible. The others can be approximate. The questions should read as follows:

1. What was your total number of newspapers printed in 1974 and what was this figure for 1973?

Total Number of Newspapers Printed

1974	1973	
50,000	48,000	

2. During 1974 how many newspapers were circulated in your town? This can be a daily, weekly, monthly, or per year average.

Number of Newspapers You Circulated in Your Town in 1974

Duration of Circulation	Average Number of Copies Circulated	
Daily	1,000	
Weekly	7,000	
Monthly	28,000	
Yearly	336,000	

3. In 1974 or 1975, what other settlements, towns or cities did you send newspapers to on a regular basis, and on an average, how many did you send to each place? Here it will be sufficient to list only those places which receive most of your circulation. The number of newspapers sent to each place can be an average daily, weekly, monthly, or yearly figure.

Number of Papers Sent to Other Settlements in 1974

Settlements	Daily	Weekly	Monthly	Yearly
Anchorage	50		1500	
Nome	50			
Galena			500	
Kenai		1,000		
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Your time and cooperation will greatly be appreciated.

Sincerely,

Kenneth A. Holm
Mod 416E University of Alaska
Fairbanks, Alaska 99701

Appendix C

The following is selected data extracted from the ABC Audit Report-Newspaper (Audit Bureau of Circulation, 1975, p. 4-5) which provides an example of the material which was used in this thesis.

ACTUAL ONE-DAY GROSS DISTRIBUTION BY COUNTIES AND CENSUS DIVISIONS:

Issue analyzed: Evening, June 24, 1975.

State County Census Division ALASKA	Actual Gross Distribution
FAIRBANKS	12,693
ANCHORAGE	216
BARROW	149
JUNEAU	51
KOBUK	39
SOUTHEAST FAIRBANKS	865
UPPER YUKON	757
VALDEZ-CHITNA-WHITTIER	75
YUKON KOYUKUK	324
Miscellaneous Counties and Census Divisions	65
TOTAL IN ALASKA	15,234
All Other	333
GRAND TOTAL	15,567

Appendix C (continued)

State Census Division or County Town	Single Copy Sales and Carriers	Mail	Total
ALASKA			
FAIRBANKS CENSUS DIVISION			
Fairbanks	9,609	32	9,641
BALANCE IN CENSUS DIVISION			
Eielson Air Force Base	992		992
Fairbanks Rural Routes	2,051	6	2,057
*BALANCE IN CENSUS DIVISION		3	3
TOTAL FAIRBANKS CENSUS DIVISION (EXCLUSIVE OF A.B.C. CITY ZONE)	3,043	9	3,052
TOTAL FAIRBANKS CENSUS DIVISION	12,652	41	12,693

*"BALANCE IN COUNTY OR CENSUS DIVISION" is comprised of the distribution in towns receiving less than 25 copies which is not identified with the towns, townships or minor civil divisions listed.